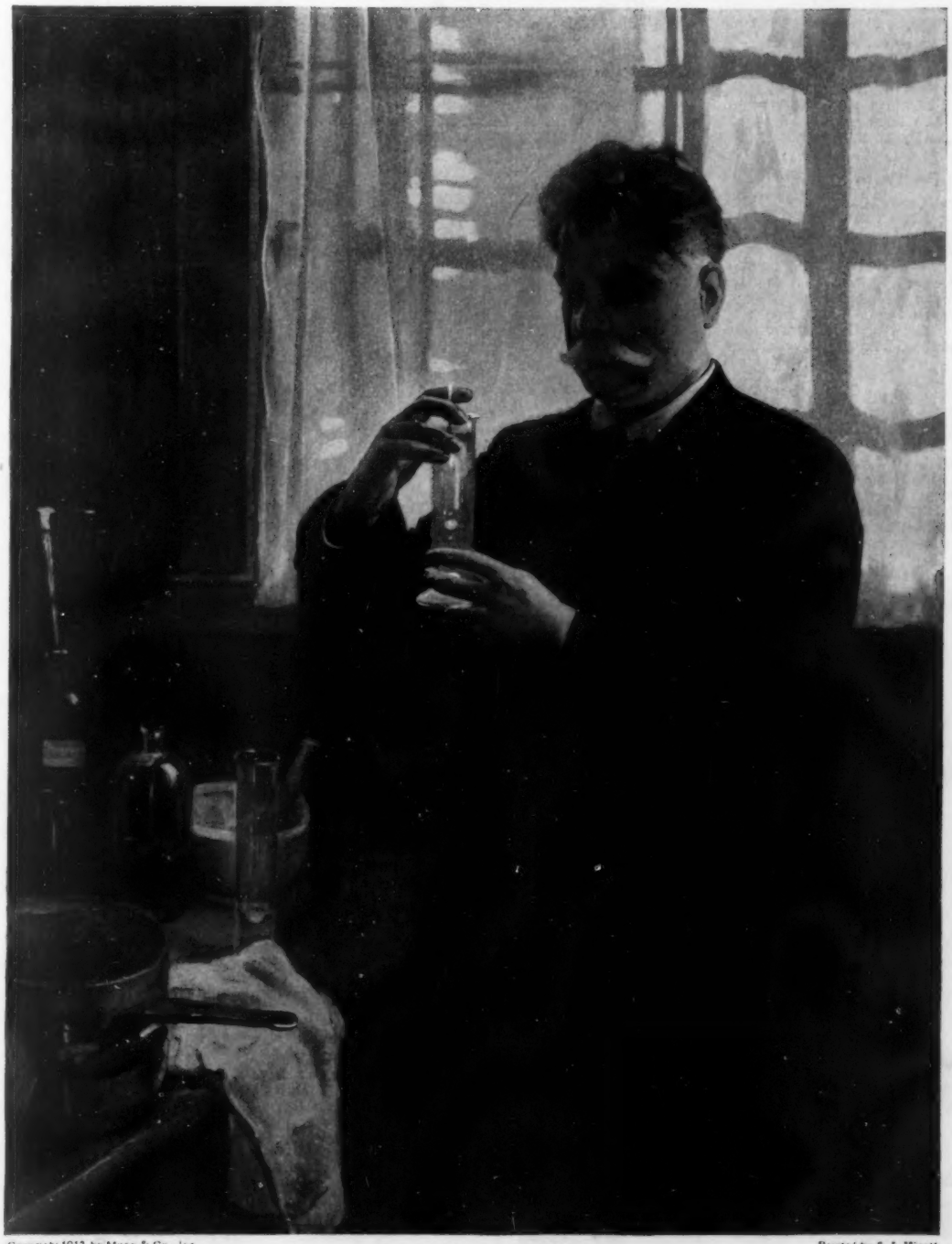
SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION



Painted by S. J. Woolf

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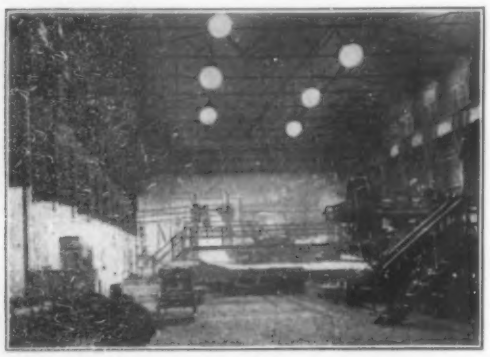
The Necessity for Correct Lighting in Factories and Mills

Scientific Lighting

It is only within recent years that the proper amount of attention has been given to the correct and scientific illumination of textile mills, iron and steel mills, factories, warehouses, etc., etc.



40-inch Mill Lighted by G-E Edison Drawn Wire Mazda, 10-450 Watt Clear Lamps.

With the engineer and analyst searching for and determining the "reason why" of many apparently unimportant occurrences, much has been elucidated in regard to the quality and quantity of the output of mill and factory.

Avoiding Spoilage

Census experts assert that because of "seconds" and spoilage, American factories lost in the year 1909, the enormous sum of $150,000,000.

Of this great amount 75% occurred under artificial light. The same census experts agree that 25% or over $28,000,000 could have been saved by good illumination.

Scientific illumination in the industrial field is even better understood to-day, and there is every reason to believe that with the highly efficient Edison drawn wire Mazda lamp, properly arranged, this saving could be even greater.

Light an Item in the Cost of Production

Regarding cost of production, the following quotation from "Electrical Merchandise" is typical:

"A busy factory, shop, or mill in the eastern part of the country, operates by artificial light on the average of about 500 hours each year. Under ordinary conditions the amount of work actually produced under artificial light is between 12 and 20% less than is produced under daylight. These facts mean that 2% of the output is cut off by after-dark work; in other words, the plant in effect runs from 6 to 10 whole days every year with absolutely no output. With this fault corrected the textile mill could get 102½ yards of cloth for every 100 yards now produced, and with no added expense for investment, overhead expense, or depreciation. Reduced to hours the loss of time amounts to between 60 and 100 hours per year per operative."

"The manager of a prominent silk mill has figured that with 100 looms, this means from 6,000 to 10,000 loom-hours entirely wasted, so that 2 or 3 looms are worn out each year without the production of a single yard of material; besides, the power to run these looms is wasted."

Accuracy Increases Business

The foregoing shows how an appreciable per cent of spoilage and waste can be avoided, and it is obvious that accuracy obtained by good illumination is in a large measure responsible for the reduction of "seconds" and spoiled goods. In the foundry also, molds are made more accurately and smoother. This keeps down the "scrap" and saves the cost of the time required for "dressing up" castings. Further, with correct illumination, work is accomplished with a greater degree of precision. Not only the quantity, but also the quality of production is increased, which brings in its wake additional orders, that indifferent shipments would fail to elicit.

Increased Production

In addition to reducing spoilage and waste, increased production always follows the substitution of "new lamps for old," and like Aladdin's lamp brings forth the genii that manifests the wonderful advantages of good illumination, heretofore undreamed of in man's philosophy.

Illumination v. Industrial Accidents

Statistics bearing upon industrial accidents, in which the operatives or machinery both suffer, closely parallel the figures touching spoilage. An accident completely demoralizes a shop, and this nervous strain may last a day or two, or a week. During this period, when the operator is expectant of further trouble, production drops, spoilage increases, and the whole spirit and morale of the plant is broken down.

Accidents Coincide with Diminishing Light

The two charts tell the story graphically of the loss and suffering that result from poor illumination. In one, the ratio between darkness, cloudiness and sunlight in the city of New York is shown. In the other is shown the wave of fatal accidents for three successive years, as reported from 80,000 industrial plants. Analyze these charts in the light of the statement of the Fidelity Casualty Co. that "the greatest number of accidents occur during the months of diminishing daylight," and it will be acknowledged that illumination is sadly underrated as a means of accident prevention.

Economy of Preventing Accidents to Employes

The Manufacturers' Association state that in the U. S. 500,000 avoidable accidents occur in one year. Authorities making a study of safeguards, claim that 25% of these accidents were caused by poor illumination. Apart from sentiment, if the cost of damages incurred by these accidents were charged to the lighting bill, they would be out of all proportion to the cost of good illumination, necessary to prevent them.

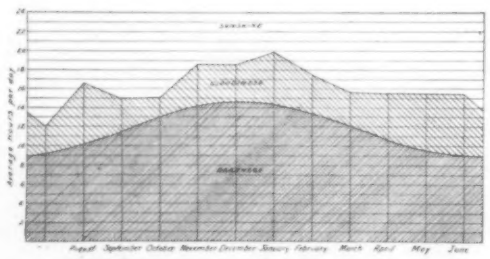


Chart Showing Average Hours per Day of Sunshine, Cloudiness and Darkness for Each Month During 1910. New York City.

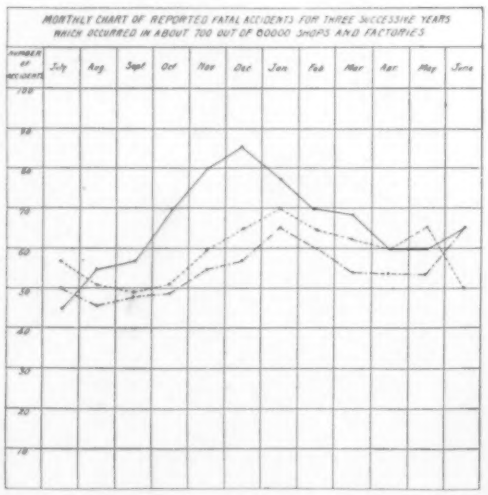


Chart Showing the Seasonal Distribution for Three Successive Years of About 700 Deaths Annually from Industrial Accidents Reported from an Area Embracing 80,000 Plants. (Note Similarity of Curves in Figs. 1 and 2.)

Economy of Preventing Accidents to Machines

The cost of good lighting for a whole day is usually less than the cost incurred by a five-minute shut-down. Good illumination lessens the possibility of holdups; adjustments or repairs are more quickly made; accidents to machinery are less likely to occur; machines can be run faster and with a greater assurance of safety; where plenty of light is in evidence no false shadows are thrown that are likely to mislead operatives and cause accident.

Flexibility of Incandescent Lamps

In order to use light effectively in manufacturing, it must be adapted to the process which it is to assist. The purpose of light is to enable the workmen to carry on the processes quickly and accurately without injury or accident to themselves or others, or to the machinery, or the product. The required amount of illumination depends upon the "fineness" with which it is necessary to see, the nature of the surface to be illuminated, and whether the workman needs to watch closely and constantly, or only at intervals. The light source should be out of the workman's field of vision, and so located that strong illumination, falls upon the surface, which the workman needs to see. Some processes are more exacting than others, and particular processes have special requirements. Edison Mazda Lamps by reason of their wide range of sizes from 15 to 500 watts, can be selected and placed in position to where a more or a less amount of light is needed. Lighting specialists figure this out carefully so that the right amount of light is located precisely in its relation to specific requirements, and no light need be wasted on unimportant sections.

Good Light Makes Surroundings Congenial

Put operatives in a poorly lighted factory, and the same feeling of oppression, felt out of doors on a dark day will take possession, an indifference and lack of interest will result. Good illumination keeps the operations more content, maintains the "esprit de corps," making work in the factory congenial and healthy. It has been proved that well lighted mills have far less trouble in retaining their employes, than poorly lighted ones. For instance, a Southern cotton mill, which had installed Edison Mazda lamps, was flooded with applications from the best operatives in the district.

The Necessity of Good Lighting

From the above, it is very evident, apart altogether from a humanitarian standpoint, that a well lighted plant is not only necessary, but is economical, successful, prudent, and logical.

The Strength of Edison Mazda Lamps

There are millions of Edison Mazda lamps giving the utmost satisfaction in textile mills, iron foundries, battleships, trains, cars, automobiles, etc., etc. These lamps have filaments of Tungsten made from a drawn wire, which is as strong as steel. Edison Mazda lamps give three times the light for the same current consumption as the old style carbon lamp; therefore, a much greater improvement in light can be obtained without adding to generator equipment or lighting bills.

Free Advice of Lighting Specialists

To secure correct and sufficient illumination throughout your plant, lighting specialists of the General Electric Company are at your service. These experts will be glad to confer with you on the re-adjustment of your lighting system, and show you how Edison Mazda lamps can be installed in your plant with the same advantage and economy that these lamps have given in hundreds of other plants. Write to our nearest sales office for full particulars.

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3745

SIXTY-EIGHTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVII. NUMBER 7.] NEW YORK, AUGUST 17, 1912 [PRICE 15 CENTS $3.00 A YEAR

A Battleship With Cruiser Speed

The Twelve-gun "Wyoming" Makes Over Twenty-two Knots

IMPROVEMENT in the motive power of ships, and particularly those of large size and power, has been as great in the boiler room as in the engine room—a fact which is too often overlooked. Not all the great increase which has taken place in the speed of warships during the past few years is to be attributed to the engines. The turbine, it is true, has done much, but superheated steam and the water-tube boiler have had a large share in the improvement.

Take the case of that handsome battleship, the "Wyoming," which recently, on its trial, made a speed of over twenty-two knots on one of its runs and an average speed of 21.323 knots for the four-hour run. The ship is driven by Parsons turbines, working on four propellers, and in the tests they gave the usual good results which we have come to expect from this very fine turbine. On the other hand, it would be simply impossible to supply the necessary amount of steam for the turbines from a battery of the old Scotch boilers. They would be too cumbersome and heavy, and space for a sufficient installation of them could not be found in the "Wyoming" without sacrificing some other necessary element in the ship. The boiler equipment consists of twelve B. and W. water-tube boilers, equipped with superheaters and all the latest requirements of up-to-date boiler practice. The total grate surface is 1,448 square feet, and the total heating surface is 64,234 square feet. The contract maximum horse-power, or in this case, "shaft" horse-power, is 28,000, which was exceeded.

It was only a comparatively few years ago that twenty-one to twenty-two knots was the standard speed for the cruiser. To-day, cruisers of from twenty-five to twenty-eight knots speed are becoming common, and battleships speeds are never less than twenty, and are sometimes as high as twenty-three knots.

The "Wyoming" is an enlarged "North Dakota;" and she embodies improvements which have been made as the results of the experience gained with that ship and her sister, the "Delaware," during the year or two that they have been in commission. The ship is five hundred and sixty-two feet in length over all, ninety-three feet two and one half inches in beam, and her mean draft is twenty-eight feet six inches. The full-load displacement is twenty-seven thousand, two hundred and forty-three tons. The contract speed was 20.5 knots, which she has, therefore, exceeded by nearly one knot. The displacement on trial was twenty-six thousand tons. The bunker capacity of the ship is 2,500 tons, but she also can carry four hundred tons of oil fuel.

The "Wyoming," and her sister, the "Arkansas," are the first battleships in our navy to mount twelve twelve-inch guns. The distribution of this battery is similar to that on the "North Dakota;" but with an additional turret. It is mounted in six turrets, all on the center line. Two of these turrets are on the fore-castle deck, and the other four are on the main deck.

The arrangement of the turrets in three superposed pairs is symmetrical and adds greatly to the handsome appearance of these ships; in fact, we do not hesitate to pronounce them the most shapely super-dreadnoughts which are now under construction for any navy of the world.

The twelve-inch guns are of the new fifty-caliber type—a most handsome piece of great power, accuracy, and rapidity of fire. When it is fired with its maximum velocity of twenty-nine hundred and fifty feet per second the energy is 52,483 foot-tons. Because of erosion difficulties, it is not likely that this velocity will be used in actual service. Probably the service charge will give about 2,750 feet per second. The secondary battery consists of twenty-one five-inch, fifty-one caliber guns, so mounted that eleven guns are available on each broadside.

The armor plan shows a belt at the water line which is eleven inches at the top and nine inches at the bottom. Above this is another belt of armor fifteen feet deep and from ten to eight inches in thickness The turrets and barbettes carry ten to twelve inches of armor.

The United States Navy may, in the future, build more powerful ships, but it can hardly produce a more handsome one than the "Wyoming."

Preventive Clinics in Industrial Establishments

THE only way to interest the manufacturer in the health of his employees is to prove to him that it pays in dollars and cents to improve factory conditions. When his profits are obviously affected, he is likely to be interested in the welfare of his employees, as a general rule. Some of the larger corporations, however, have reached a stage where they regard the health of their employees as they do their own, not from a mercenary point of view, but simply as a matter of fair play.

The whole matter is excellently considered by Dr. James A. Honeij in *The Engineering Magazine*, from which we quote the following paragraphs:

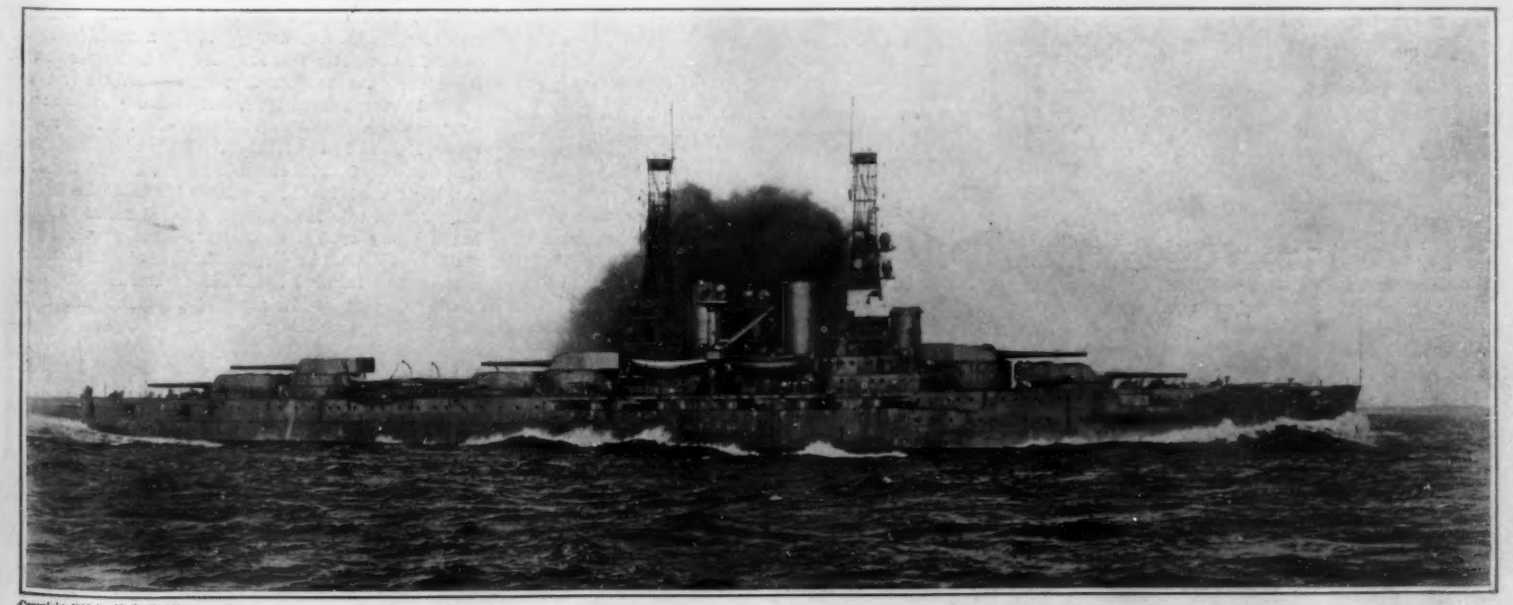
"Increased profit is represented by a more healthy, energetic attitude of the employee toward either his work or the purchasing public. If ventilation, temperature, and humidity are improved, and if an existing physical disturbance is corrected, physical action as well as mental activity must necessarily be greater. In piece work this is apparent. When the market demand is large, and space is limited, it is imperative that the individual piece worker not only be relied upon to produce a certain number of articles, but often he is urged to increase it. Does the atmospheric and physical condition have anything to do with the profits of the employer? Most decidedly.

"In general, then, we can demonstrate the economic basis for a preventive clinic. A case showing the importance of ventilation is cited by C. E. A. Winslow where the New England Telephone and Telegraph Company at Cambridge, Massachusetts, had installed a simple ventilating system in their operating room, in the spring of 1907. Dr. Winslow states the following in his report on the 'Cash Value of Factory Ventilation':

'The change in ventilation did not affect the attendance in the operating room during the summer of 1907. No direct effect could be expected at this season, since in warm weather, with windows open, natural ventilation of the room could scarcely be improved upon. During the winter of 1907-1908, however, a marked improvement was manifest. For the first three months of 1906 the average percentages of operators absent were 4.9, 5.6, and 4.1, respectively; for 1907 the figures were 5.2, 5.0, and 3.4; for 1908 they dropped to 1.8, 2.4, and 1.5. Comparing the three winter months only (January to March), it appears that 4.9 per cent of the force were absent in 1906, 4.5 per cent in 1907, and only 1.9 per cent in 1908. This means a net saving for the three months of 2.8 per cent of the force employed, corresponding to one and eight-tenths the entire time of one operator.

'The original cost of installing the system of ventilation was in the neighborhood of $75. The saving in operator's time during the three winter months amounted to 23 working weeks, as indicated above (13 weeks × 1.8). Since the average pay of an operator is $8.50, this meant a saving of $195 to the employees in wages, and the increased efficiency due to the regularity of attendance paid good interest to the company.'"

Another case is cited in which the cost of installing a ventilating system was $6,000; the reduction of the percentage of absences due to illness was so great that the employer was compensated for his outlay; and while previously the employees were likely to become stupid in the latter part of the afternoon, the new system maintained alertness during the entire day.



Length, 562 feet; beam, 93 feet 2⅛ inches. **Mean draft,** 28 feet 6 inches. **Displacement,** 26,000 tons. **Full load displacement,** 27,243 tons. **Speed,** 21.3 knots. **Armament;** twelve 12-inch 50-caliber guns, twenty-one 51-caliber, 5-inch. **Armor;** belt 11 to 9 inches upper belt 10 to 8 inches; **turrets,** 12"inches. **Torpedoes,** two 21-inch, submerged.

"WYOMING"—FIRST 12-GUN DREADNOUGHT OF THE UNITED STATES NAVY

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Merchant Marine—Free Canal Fallacy

THE United States Senate by vote of eleven to forty-four has refused to strike from the Panama Canal bill the provision granting free passage through the canal to American ships. The correspondent of the *Times* at Washington is of the opinion that the overwhelming nature of the vote shows that there is no chance that further debate will change the matter before the bill is finally disposed of.

This action of the Senate means that it is the deliberate purpose of that body to violate the letter and, as many of us see it, the spirit of a most clearly-stated treaty obligation.

But it is not of the moral aspect of this question that we are about to write—we did that in our last issue. What we wish now to point out is that in exchange for this playing fast and loose with international obligations we are about to obtain a very doubtful compensation. The country is asked to believe that the remission of tolls to American ships using the canal, will prove to be a powerful and very effective agency in building up our defunct merchant marine. As a matter of fact, it will do nothing of the kind. So far as coastwise shipping is concerned, that is already protected; for the ships of foreign nations are prohibited from engaging in such trade. To remit tolls to coastwise shipping will be in effect merely to divert a certain portion of the profits of the canal from the National Treasury into that of the shipping companies that are benefited.

Equally short-sighted and fatuous is the belief that the remission of tolls will benefit our deep-sea shipping as a whole, and bring about a general revival of the American Merchant Marine. The causes which underlie the present moribund condition of our oversea trade lie too deep to be reached by any such expedient as the remission of canal tolls. The relief afforded would be too local and limited. Consider, for instance, our trade with South America. The remission of tolls to ships engaged in that trade would mean that those ships which run to South American ports on the west coast would receive the benefit of Government assistance, while those which run to ports on the eastern coast would receive no benefit whatever. On what practical grounds could such a discrimination be justified? Why should our trade to the western coast of South America, to Australasia, and to the Orient be so greatly assisted, and the trade to South American and European ports be left in its present hopeless condition?

The upbuilding of our merchant marine is one of the most complicated and difficult problems that ever confronted the Federal Government. The question should be considered upon broad and statesmanlike lines, and any stimulus that Congress may apply should be of a kind that will go to the very heart of the problem. The external application of a quack remedy (for such is this free-toll movement) will never do more than give a relief that is local and temporary. Our deep-sea shipping as a whole will remain in its present comatose condition.

The gain will be slight. The cost in loss of international prestige and reputation for square dealing (and as a people we have always prided ourselves upon that) will be appalling!

We note that one of the amendments to the bill calls for the admission to American registry of foreign-built ships exclusively owned by Americans. We are not prepared to admit that such admission would be altogether a benefit; but as a means to the end desired, it is infinitely preferable to the original bill.

If the Senate sincerely wishes to promote American shipping, let it do something that is at least statesmanlike and consistent with that high standard of international morality which the citizens of this great republic still fondly believe to be one of our greatest national assets.

Archeology, Sulphur, and Cyrene

GREAT industries have often been associated with the elements of physical danger confronting those who engage to further them. The hazard is ten-fold increased when the operations are carried to, and even beyond, the frontiers of civilization. The history of every great enterprise of European or American capitalization that has spread to remote lands and alien peoples, records death and suffering.

To ascribe to the competition within the zone of civilization of two great industries the untimely death of an American citizen not even remotely identified with those industries and laboring in archeological research on a bleak stretch of North African coast would be to presume upon the credulity of a reader of fiction. But an instance of the truth that is "stranger than fiction" is revealed by the train of circumstances that led to the murder at Cyrene, in Tripolitania, a year and a half ago, of Herbert Fletcher deCou, of Michigan.

In the columns of this issue of the SCIENTIFIC AMERICAN there is marshaled indisputable evidence to show that DeCou, who was a member of the expedition sent to Cyrenaica by the Archeological Institute of America, met his fate indirectly as the result of the legitimate, but none the less determined, rivalry between the centuries-old sulphur industry of Sicily and the sulphur industry of Louisiana, youngest of America's "infant industries." The evidence also goes far toward establishing the fact that the inordinate Sicilian fear and suspicion born of that industrial conflict was a contributory cause of the present war between Italy and Turkey.

DeCou was plainly an innocent victim of circumstances that, for the most part, operated quite without his sphere of life, but that in an evil hour shifted only to center upon the desolate Acropolis of Cyrene, where he toiled with a scholar's rapt enthusiasm on behalf, not of industry, not of commerce, but of the science of antiquities. His lonely grave on the face of the plateau of Cyrene, "looking out westward, toward the homeland," to quote the description reported to the Archeological Institute of America by Prof. Richard Norton, of Harvard University, who directed the expedition, bears mute, but eloquent, testimony to the fact that the life-risk which attends the onward march of modern industry may, by an abortive sequence of events, find a sacrificial victim even in the pursuer of a totally divergent calling.

How deep-seated was the antagonism which the presence of the American expedition at a point several hundred miles away from the coveted sulphur region of Gebel-el-Gebrit created in certain Italian quarters is to be gauged from Prof. Norton's report of the trials which beset the party in their efforts to obtain an actual start of operations on the site of Cyrene. The Senussi tribesmen whom they employed levied upon them for an exorbitant wage, and concerning this the director observed:

> The reason why I agreed to this high rate (10 piasters or about 30 cents a day) was that I wished to convince the Arabs, as soon as possible, of the advantage to be derived from our presence. One reason that they demanded it was that reports had come to them from Benghazi that if they refused to work for us and forced us to depart, our concession would be taken up by Italians, who would pay them one mejidie (about $1) per day.

Of noteworthy interest, also, is Prof. Norton's statement that "there is reason to suppose the bullets were intended for the director, and that the purpose was to thwart the undertaking by driving the Americans from the country."

The fact remains that the immediate cause of the DeCou tragedy was a criminal plot against American life and an American undertaking. Suspicion points to Sicilian influence in, if not direct Sicilian instigation of the murder. The current recital of the history of the Sicilian sulphur industry, which has always been closely identified with the political life of the island principality, demonstrates how serious, how vital a menace American control of the sulphur deposits of Cyrenaica must have seemed to the Sicilians. It must have loomed to the stature of economic disaster before their affrighted gaze. In the light, or rather the shadow, of so grave an impending catastrophe, their energetic protests to Rome and the violent utterances of their local press were justified.

Had Cyrenaica been under any civilized dominion, it would have been a relatively easy task for Italy's diplomatic representatives abroad to definitely ascertain whether, as the Sicilians feared, a concession for the exploitation of sulphur in Cyrenaica had been granted to the Americans. Once the truth were known, the excitement of Sicily would have been allayed.

But the Italian Government was dealing with the Porte, whose power and strength have ever been derived from secret intrigue, falsehood and dishonesty. Instead of frankly meeting Italy's rightful inquiry upon the subject, the Ottoman authorities proceeded to make a fancied capital of the suspicion and disquietude of the Italians—to their great cost, as it has since proved. The war followed, and a fearful toll of Arab life is avenging Turkey's deliberate sacrifice of the life of DeCou.

The Use of Ozone for Purifying Air

SOME very satisfactory results have of recent times been obtained by the use of ozone as a disinfectant and deodorizer for impure air, such as has to be reckoned with in crowded halls, in certain industrial workshops and in other places. The use of ozone, however, has its limitations, and in order to successfully and intelligently apply this agent, it is necessary to understand these limitations. The subject is discussed in a paper by M. O. Troy, published in the *General Electric Review*. Experiments on the effect of ozone upon bacterial cultures have shown that the bacteria near the surface of the culture may be more or less completely destroyed, while the deep-seated bacteria are affected but little or not at all. This is only what we should expect, for ozone, coming in contact with the organic material of the culture medium, oxidizes the same, and is at the same time itself reduced to ordinary oxygen. Thus there is no opportunity for any ozone to reach the bacteria in the deeper layers of the medium. As regards more particularly the action of ozone upon impure air, it must be remembered that the ozone will not only attack bacteria and other bodies which it is intended to destroy, but will at the same time act upon all organic matter present, some of which might have been removed by other, cheaper means, such as filtering. It is needless to point out that it is sheer waste to consume considerable quantities of ozone in the oxidation of such removable impurities, to say nothing of the fact that these may take up all the ozone supplied, giving it no opportunity to react satisfactorily upon the substances for which it is particularly intended.

As for the field of usefulness of the ozonizing process, it has already been pointed out that this extends particularly to crowded rooms and workshops. As special examples of the latter may be mentioned, the shops for assorting rags, factories for the manufacture of fertilizers, and those which work gelatine, glue, hides, hair, fat, bones, horn and other slaughter-house by-products. Such installations, the emanations from which constitute a nuisance and a menace to the public health, may with great profit apply the ozone treatment.

Several instances are on record in this country, in which the ozone treatment not only proved a very efficient remedy for conditions of bad air, but did so in circumstances in which other means had failed, or were for some reason inapplicable. Thus a moving picture show in Schenectady had experienced difficulties with its ventilation. The management were very desirous of providing the best ventilation possible, and had gone to considerable trouble in setting up the requisite equipment, but all to no avail. A larger blower could not be installed without giving rise to objectionable draughts. As a solution of the trouble an ozonizer was installed, with the result that the air in the theater is now perfectly sweet and odorless, except for a faint and rather pleasant smell due to the small excess of ozone. Similar results were obtained in a workshop, the air of which was at times rendered uninhabitable by vapors arising from a solvent used in the process of manufacture. Not only was in this instance the desired relief obtained, but a costly system of draught pipes previously installed could now be dispensed with. In another case a store was invaded by clouds of smoke from a fire in an adjacent building, and the owners saw before them the prospect of much loss owing to the difficulty of eliminating the odor of smoke from the rooms and from the goods. Here also, an ozonizer completely saved the situation.

In the sterilization of air, the ozone should be blown into the apartment, or the air should be drawn through a special chamber in which the ozone is mixed with it. It is important that the ozone come freely into contact with each individual particle which it is desired to destroy.

The machine for producing the ozone should not produce any nitrous oxide or any other gas having an untoward action on the human organism.

The generation of ozone should continue until the air, as determined by experimental test, is thoroughly sterilized, and the machine should produce this result without loading the atmosphere with ozone to an injurious concentration.

Engineering

The Bicycle Holds Its Own.—Statistics recently published show that the bicycle is more than holding its own in France. It seems that the total number in that country for 1910 was 2,697,406, and that this had increased in 1911 to 3,900,626. Although, as a means of recreation, the bicycle still survives in Europe only. It is certain that both in the eastern and western hemispheres it has taken a permanent position as a useful means of travel, particularly for the artisan population.

Oil-fired Battleships.—The new battle ships "Nevada" and "Oklahoma," which were recently illustrated in the SCIENTIFIC AMERICAN, are to burn fuel oil exclusively; and naval officers will watch the results of this new venture with keen attention. The advantages are many: fireroom weights have been decreased about 300 tons; there is a decrease in the weight of fuel for a given steaming radius as compared with coal, and there is a decrease in the fireroom force of about 50 per cent. Very valuable also is the saving in the length of space required for the boilers and firerooms. For coal firing 128 feet of the ship's length would be required, whereas with oil firing the length of the "Nevada's" boiler rooms will be only 66 feet.

The Largest Sidewheel Passenger Steamer.—Very interesting is the continual increase in the size of both freight and passenger steamers which is noticeable on the Great Lakes. The new steamship, "City of Detroit III," which is now in commission, is the largest sidewheel passenger steamship in the world to-day. In the history of steamship construction she has only been exceeded once, and that was by the "Great Eastern," which was 692 feet in length. The "Great Eastern," however, was both paddle- and screw-propelled. The "City of Detroit III" is 500 feet over all, 55 feet broad molded, 100 feet over the guards, and she has a molded depth of 22 feet. We shall have more to say on this fine vessel at a later date.

The Clyde and the Diesel Engine.—According to the *London Times*, the Clyde shipbuilders have an objection against the Diesel engine on the ground of its lack of flexibility as compared with the steam engine, claiming that it must be kept running at a fair speed or it will stop altogether, whereas the steam engine can be run either ahead or astern at any slow speed desired. The makers of reciprocating engines of the smaller marine type state that this is the principal reason why the oil motor is not making more headway. But a Diesel engine consumes less than half the amount of fuel and is in every respect far more economical, and hence it is certain that the objection above named will be met and fully mastered; indeed, the reduction gear would solve the problem at once.

German Naval Increase.—At the last annual meeting of the German Navy League, under Admiral von Koster, the president, in his opening speech, stated that the new navy law provided that by 1917 there would be in the navy forty-one battleships and twenty armored cruisers. Yet, in the face of these facts and of our recent emphatic reassertion of the Monroe Doctrine, there is a determined attempt to prevent the construction this year of our moderate naval programme of two battleships per annum. The people of the United States, we firmly believe, are thoroughly in favor of the moderate two-ship program. Taxpayers throughout the country should give their representatives in Congress to understand that the proposed cessation of building is extremely unpopular.

Vehicle and Pedestrian Traffic.—Any one who is abroad on the streets of lower New York at the noon hour—at any hour of the day, for that matter—must feel that the time is near when the question of providing further foot-passenger accommodation is very near at hand. We have frequently advocated the separation of pedestrian from vehicular traffic. The simplest way to do this would be to double-deck the streets, not necessarily across their full width, but by providing above each sidewalk additional sidewalks for foot passengers at the level of the first floor. Apart from the loosening up of congestion which would be secured by this arrangement, the provision of sheltered sidewalks at street level would be greatly appreciated, especially during the rainy weather.

First Voyage of the "Selandia."—An inspection of the Diesel engines of the "Selandia" at the conclusion of her first round voyage (of 21,840 miles) shows that they went through the trial with most satisfactory results. No defects whatever of a mechanical character were developed, and both the navigating and engineering officers speak in the highest terms of the performance of the vessel. The piston rings and the cylinders were found to be perfectly clean; the exhaust valves, according to the engineers, were examined twice and most of them needed nothing more than to be cleaned and ground in. The voyage, says *The Engineer*, has shown that 9,300 tons of cargo can be carried a distance of nearly 22,000 miles on a consumption of 9 tons of fuel for each day of 24 hours. This was done, moreover, with an engine-room crew of ten men and three boys.

Electricity

Wireless in Siberia.—The extreme northeastern corner of Siberia will be in radiotelegraphic communication with Vladivostok by the end of the present summer. Stations are in course of erection at Mayahama and at Novo-Markovo, at the mouth of the Anadyr River.

Shocks from Pole Lines Exposed to Electric Waves.—That high power Hertzian waves emitted by modern wireless telegraph stations are capable of setting up high electromotive forces in metal structures in the immediate vicinity of the stations, was recently shown in Paris. Some workmen on a section of telegraph line experienced severe shocks when they touched the wires. Investigation showed that the source was the great Eiffel Tower wireless station.

Ignition of Mine Gases by Electric Spark.—Many accidental explosions may be traced to the "touching off" of gases by electric sparks. A recent colliery explosion appears to have been caused by the tiny sparks at the trembler contact of an ordinary electric bell; the accident emphasizing the need for providing absolutely sparkless electrical apparatus of all kinds in mines, factories, or anywhere that explosive atmospheres are likely to exist.

Electrical Means of Destroying Marine Boring Worms.—A way has been found to check the ravages of the teredo in destroying wood structures such as the submerged piling of wharves by means of a special floating electric power plant connected to submerged electrodes permanently wired to the wharf. Chlorine gas is electrolytically generated in the salt water, and the chlorine effectually cleans out the colony of teredos which are attacking the wood. An occasional treatment only is sufficient.

The Largest Single-phase Locomotives.—The most powerful single-unit electric locomotives that have been designed up to the present time are now being built for a Swiss railway. These locomotives, ten in number, weigh 108 tons each, total, and have a weight on their ten drivers (adhesive weight) of 85 tons. They are capable of developing 2,500 horse-power at a speed of fifty miles per hour, with a possible increase of speed to seventy-five miles per hour, for an uninterrupted run of 1½ hours, and can exert a drawbar pull of 18,000 kilogrammes from the standstill.

Electrolysis Ordinance in Chicago.—The city council of Chicago has recently passed an ordinance requiring certain electrical equipment to prevent damage by electrolysis. It requires that the difference of potential between any two points on a return circuit must not exceed twelve volts and between any two points on the return a thousand feet apart, within one mile radius of the city hall shall not exceed the limit of one volt, while between any two points on the return seven hundred feet apart, outside of this mile radius, it will not exceed the limit of one volt. Return current amperage on pipe and cable sheaths must not be more than five tenths ampere per pound-foot for caulked cast iron pipe, and eight amperes per pound-foot for screwed wrought iron pipe, and sixteen amperes per pound for standard lead or lead-alloy sheaths of cable.

Wireless Distress Calls Not to Go Unheard.—One of the most noteworthy steps taken during the International Radio-Telegraphic Conference which opened in London June 4th and closed July 5th is the laying down of a practical rule for attendance on the wireless apparatus on shipboard. It will be recalled that the "Titanic's" distress signals went unheard by vessels in the immediate vicinity because the single operator employed on those ships was off duty at the time. Under the Conference rule, a permanent watch is required on ships of the first class, which means that two operators must be employed, and on ships of the second class, employing only one operator, the receiving apparatus must be attended during the first ten minutes of each hour. In order to allow the operator to have his rest unbroken when off duty, this provision will probably mean that one of the crew trained to receive the distress signal, will be required to listen during the ten minutes beginning each hour.

Fusing Platinum in Quartz.—How to fuse platinum wires into quartz tubes, so as to make a good joint, is no small problem. M. Berlemont presented his new method to the Academie des Sciences not long since, and claims to have been successful. The difficulty is that quartz melts at as high a heat as ,800 deg. Cent. and has a very small expansion value, while all the metals expand to a much greater extent and also melt at a lower temperature. After numerous attempts to make a joint, first by direct fusion, and then by an indirect method, such as the use of glass or enamel, oxides or electrolytic deposits between the wire and the quartz, M. Berlemont came back to the direct method of imbedding the metal in the quartz, using a platinum-iridium alloy. By an improved process, requiring some skill, he could make a tight fused joint which would stand a high heat without damage, and was thus able to make all kinds of quartz tubes with fused electrodes.

Aeronautics

Hydro-aeroplanes at Aix-les-Bains.—The municipality of Aix-les-Bains, one of the principle watering places in France, is engaged in organizing a concourse of hydro-aeroplanes with the aid of the Aero Club. Flights will be made upon the Bourget Lake on this occasion, from September 14th to 20th, and there will be several prizes, amounting to a total of $10,000. All the flights are to take place on this picturesque lake and the event will no doubt be an attractive one.

A Flying Corps Bill.—The House of Representatives recently passed a bill authorizing the detail of thirty naval officers and thirty army officers for aviation duty at double their regular pay. Officers of the Marine Corps are included in the authorization to the Navy. The length of the detail is made four years, but it may be renewed. It is also stipulated that at any time an officer so detailed may be sent back to his regular duty if for some reason he should become unfitted for flying.

A British Aeroplane Gun.—Experiments with a quick-firing gun in an aeroplane were made by the Royal Flying Corps at Farnborough, on July 25th. The test was made in a stiff breeze at a height of about four hundred feet. Some twenty rounds of ammunition were fired at imaginary objects on the plain directly beneath the aeroplane. The recoil is said to have had but little effect upon the steadiness of the machine. A biplane was used, built in the army factory. It was especially strengthened in order to carry the weight of the gun and ammunition.

The First Theft of an Aeroplane.—The first case of stealing an aeroplane occurred not long ago at the Puchem aerodrome at Munich. When the pilot, Belat, arrived in the morning he found that some one had broken into his hangar and that the monoplane was missing. On inquiry he found that several persons in the neighborhood had heard the noise of a motor about 2 o'clock in the morning. Apparently some enterprising pilot had flown away with the machine. In the suburbs of Munich policemen were kept busy scanning the horizon in search of the flyer. Up to the present writing the machine had not been recovered.

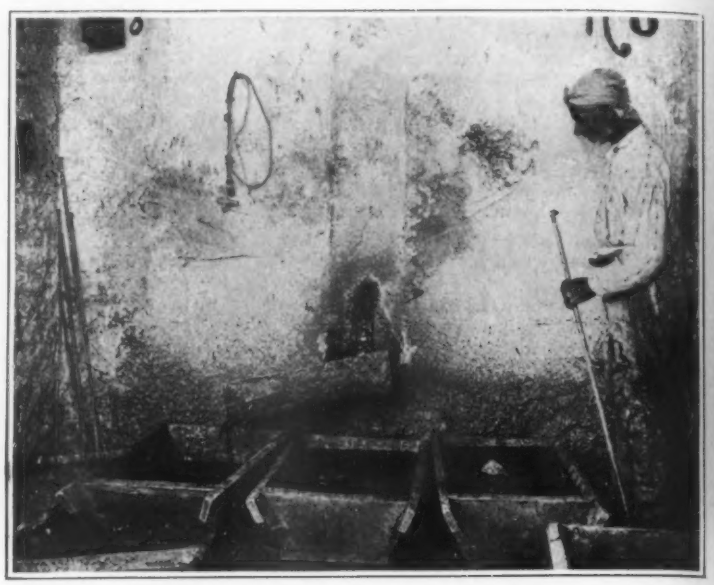
Statistics of French Balloon Ascensions.—Figures show that the number of balloon ascensions in France during the first six months of this year is greater than ever before, this referring to spherical balloons. From January 1st to June 30th, there were made two hundred and fourteen ascensions, for which the amount of gas used was 243,000 cubic meters (7,300,000 cubic feet). The number of persons taking part in these ascensions was six hundred and thirteen, of which there are counted one hundred and twenty-eight officers appointed for the purpose by the War Department, also ninety-seven women aeronauts.

Proposed Aeroplane Flight from London to India.—The Peking-Paris aeroplane flight for which a prize has been offered by the Paris *Matin* has inspired English aviators with the project of arranging a flight from London to India, and a committee has been organized in London to push the scheme. The proposed route is across Germany to Vienna, thence by way of the Shipka Pass and Adrianople to Constantinople; then along the route of the Anatolia Railway to Aleppo; thence to Bagdad; thence along the shores of the Persian Gulf and the Arabian Sea to Karachi; a total distance of 4,500 miles. It is expected that at least three aviators will take part.

The Coming French Show.—The fourth international aeronautic show which will be held at Paris in the Grand Palace is likely to outdo its predecessors in interest. As to the decoration, it is proposed to use the new aeroplanes which are being built by public subscription for the army. These will be hung in an attractive way so as to make quite an impression upon visitors. It is not certain, however, whether this plan will be realized. As regards the exhibits, these are divided into thirteen groups, comprising spherical balloons and airships, aeroplanes, motors and helices, scientific work and apparatus, works of art, material and machine tools, transport and shelter, maps and books, commerce, various industries and manufactured objects, motor-boats, societies, touring.

Biplanes for Greece.—The fleet of biplanes which H. Farman's establishment delivered to the Greek Government not long since for military use is now engaged in very good flights in that country. More recently, Lieut. Kamberos mounted on one of the biplanes, which was transformed to a hydroplane, set out to make the over-sea flight from Athens to Hydra, the distance being about 50 miles. Starting from the port of Phaleros at 9 o'clock in the morning, he sailed above the Salonique Gulf and then rose to a great height and flew toward Hydra in spite of a very stormy wind. The torpedo boat "Nike" accompanied him. He alighted at the port of Hydra, after making the trip in forty-three minutes at an average speed of fifty-five miles an hour, and he flew back to Athens on the following day.

Characteristic scene of sulphur operations at Caltanisetta, Sicily, showing crude product heaped in mounds, ready for shipment.



Molten sulphur pouring from melting furnace into molds at Caltanisetta; Sicilian mine worker "on the job."

Sulphur at Home and Abroad

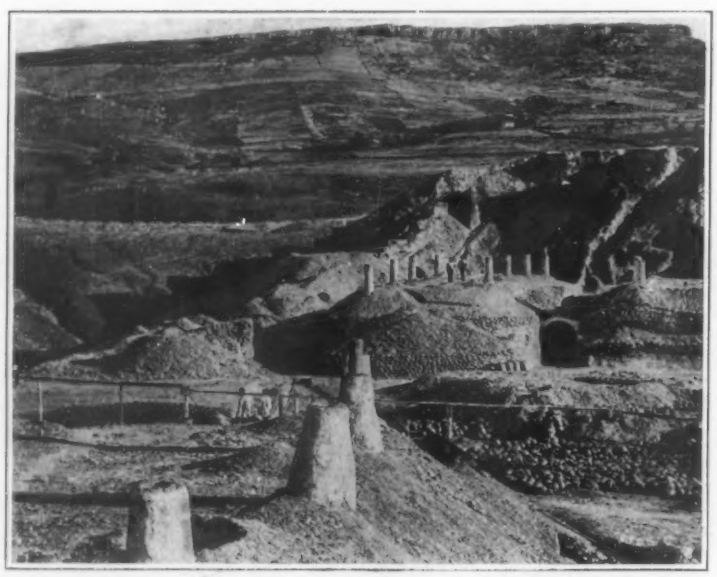
A Contrast Between American and Sicilian Methods

By Harry Chapin Plummer

SICILY'S sulphur production centers in the southerly angle of the island and comprises an area about equal to that of the State of Connecticut. A population of 500,000 is directly dependent upon the industry, and of this at least 350,000 are ignorant, ill-nourished peasants, called "carusi," who labor in the mines.

The minable deposits extend from Centuripe, in the Province of Catania, on the east, to Gibellina (Province of Trapani) on the west, and southward as far as the coast. The richer deposits, all under operation, occur within an area of from 99 to 105 miles in length, and from 53 to 56 miles in width. The sulphur, which in structure is massive, or coarsely crystalline, but usually compact, is found chiefly in an argillaceous limestone, associated with gypsum and bituminous marl. The sulphur-bearing rock takes the form, not of extensive beds, but of immense lenses of variable thickness and richness, and there are usually present from three to four sulphur layers.

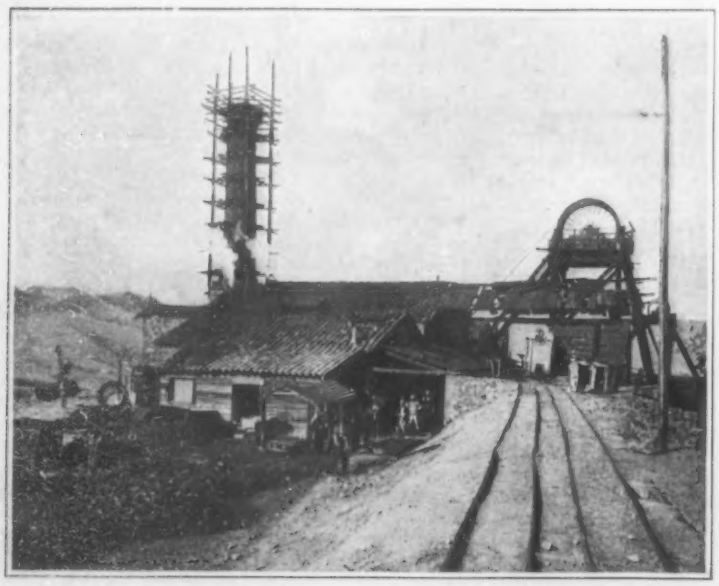
Exceedingly crude and simple methods prevail, and have prevailed since the days of the Romans, in the mining of Sicilian sulphur. Steps hewn out of the rock lead to tortuous and disordered subterranean galleries attaining to depths of from 500 to 825 feet, but averaging about 600 feet. The crude ore is heated to the melting point of 115 deg. Cent., and collected as it is run off. There are two methods by which the sulphur is heated: one, by burning part of the mineral in what are locally termed *calcaroni*, or beehive ovens; the other by means of superheated steam forced into the deposits by hydraulic pressure, somewhat after the system in vogue at the American sulphur wells in Louisiana.



Mined lumps of sulphur at base of mounds, Caltanisetta, and calcaroni, primitive ovens in which the sulphur is heated.

One of the most drastic moves in the history of the Italian Parliament was made necessary by a crisis that arose in Sicily in 1906. It was the passage of an act by which the 180 sulphur producers of the island were forced to combine in a *consortium*, or state trust, and thereafter to deliver their product over to the Government, as mined. Among the members of this trust, which is known as the Consorzio Obbligatorio Zolfifero Siciliano, are princes, senators, and deputies of Sicily, and a one-time minister for foreign affairs of Italy.

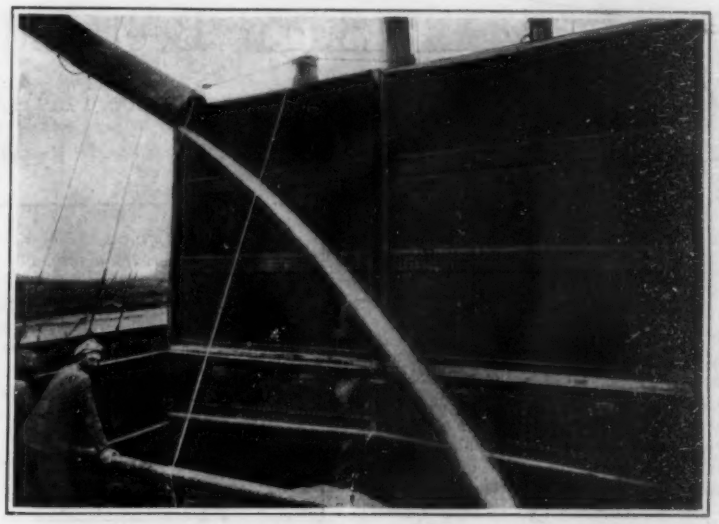
The Sicilian industry, debilitated by



Mechanical operating plant of Jordan sulphur mine at Caltanisetta, with trackage and coke dump.

Molded cakes of refined sulphur cooling near smelter at Caltanisetta; atop of them two typical "carusi," or boy miners.

This is a huge bin forty-eight feet high and two hundred feet long into which liquid sulphur is being pumped.



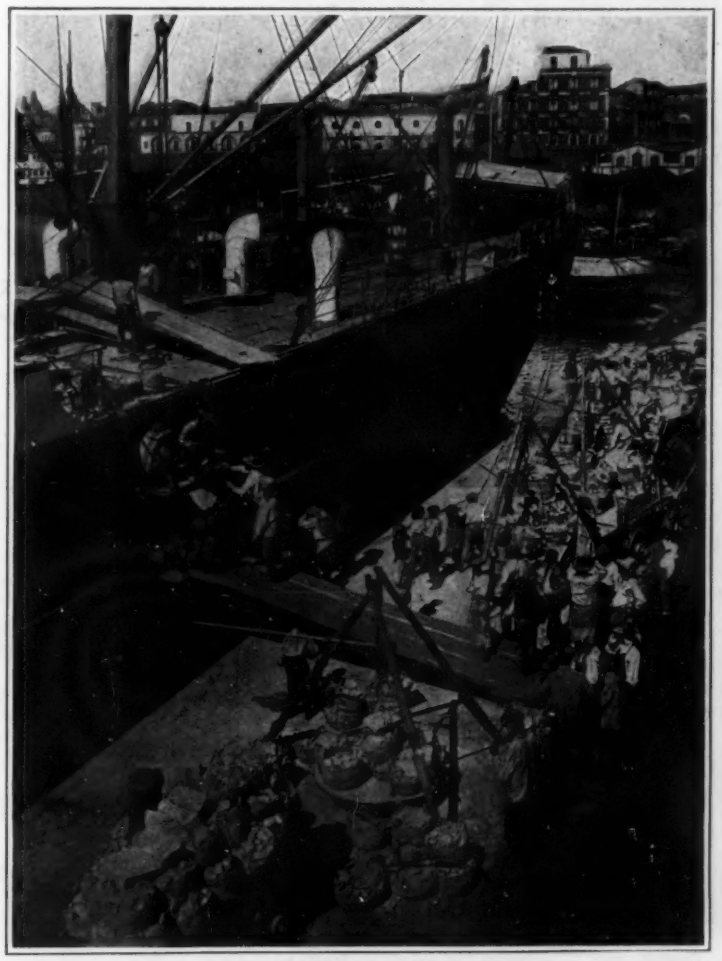
Loading a vessel with Louisiana sulphur at the rate of sixteen tons a minute. Contrast this with the method of loading Sicilian sulphur.

ages of market speculation, usury and local *vendette*, late in the last century, staggered under the shock of news of the opening up of an immense deposit of sulphur on the gulf coastal plain of Louisiana.

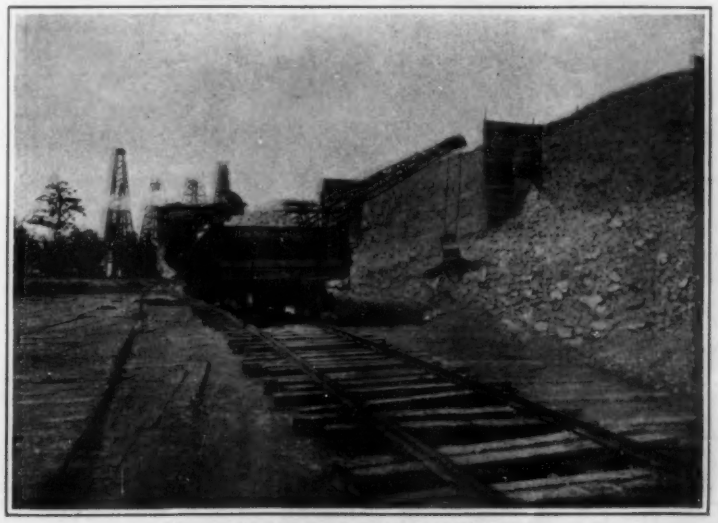
By Herman Frasch's invention of a process for liquefying sulphur in the ground, at a depth of 1,000 feet, and pumping it to the surface in fluid form, an immense alluvial deposit of sulphur in Calcasieu parish, Louisiana, on the Gulf of Mexico, was opened up in 1893. The deposit was in the form of a volcanic cone, the apex of which was 800 feet from the surface. An eminent Italian engineer, Dr. Baldacci, delegated by his Government to investigate the report of the discovery, that had quickly reached Europe, not only confirmed it, but estimated the newly found store to aggregate 40,000,000 tons, or more than sufficient to meet the world's requirements for an entire generation. What most alarmed the Sicilians, however, was the fact, as reported by Dr. Baldacci, that the Louisiana sulphur was produced at an average cost of $3.68 per ton, as against $12 per ton, the cost of mining sulphur in Sicily. Water, superheated to 350 deg. Fahr., was sent into the ground in Louisiana, in columns wherein a pressure of one hundred pounds per square inch was maintained. When dissolution was effected, the liquid sulphur was pumped into great bins of about 150 by 250 feet, where it solidified to the consistency of sandstone, and awaited the attack of workmen to break it up, by blasting, for shipment.

The wells were sunk in groups, the individual wells being placed fifty to one hundred feet apart, and a single well would be found to have a daily production of four hundred to five hundred feet of sulphur and to keep up a steady flow for months at a time. The liquid sulphur as it flowed from the well was so pure that the company was able to guarantee a sulphur content of 99½ per cent, but the average purity well exceeded that figure.

Twenty 150 horse-power boilers were used for a single well, and this represented experimentation on a ponderous scale. The number of boilers employed to superheat the water used in the pumping has since been increased to 130, each of 150 to 300 horse-power, and arranged in eight batteries, containing with one exception 15 to 20 boilers each, and each battery of boilers capable of operating a well. Two of these batteries are placed in a group, so that one foreman can oversee both. The boilers are fired exclusively with fuel oil, pumped from wells located on the premises, and only three men, two firemen and one water tender, are required on each shift to the firing and the feed water in each battery. Similarly great economies have been effected in the dispatching of the sulphur for shipment. A flat car receives a load of thirty-five tons within fifteen minutes, while at the company's docks at Sabine Pass, Tex., about fifty miles away, one man is enabled to effect the automatic discharge of an entire train load in a few minutes, unassisted, and chartered steamships and, of late years, vessels of the company's own fleet have loaded more than ten tons per minute and sailed, laden with cargoes of 7,000 tons each, within twenty-four hours after arrival at Sabine Pass. A striking contrast to the slow, laborious method of transferring the sulphur from the Sicilian stores at Porto Empidocle and Catania to waiting ships by hand, in baskets of but a few bushels each!



Shipping sulphur at Catania, Sicily; antiquated methods of weighing and loading by hand labor, in baskets of straw, are shown.



Locomotive derrick in Louisiana taking up its charge of sulphur two tons at a time.

Confronted by this sudden development of a formidable competition in 1905, the Italian Government realized the seriousness of the situation. It learned that the newly born sulphur interest, youngest of America's "infant industries," had not only intrenched itself in the markets of the United States and Canada, hitherto monopolized by the Sicilian product, but that it had begun an aggressive campaign in the European field. It had even built at Marseilles a great refinery for the treatment of the Louisiana sulphur, brought to the French port in its own ships.

Premier Luzzati, who was then at the helm of Italy's Ship of State, resolved upon a step which showed how critical he regarded the situation that existed. He sought out the head of the American interest, Herman Frasch, the "wizard" of the Louisiana wells, who journeyed from Marseilles to Rome upon the invitation of the great statesman.

In the course of a memorable conference between the two, the Italian Prime Minister dwelt upon the economic significance of the plight in which the Sicilians found themselves.

Frasch pledged his company to restrict their operations on the continent of Europe to such consumers as they had already contracted with, provided that the Sicilians would abandon the American field.

The organization of the Consortium, or state trust, followed, with the resulting shut-down of 120 of the 484 mines. The employees of these, the smaller of the island's mines, were disbanded. But the attendant privation was minimized and the extreme results that the Government feared were obviated. Most of the laborers forced out of employment later swelled the tide of Sicilian emigration to the United States.

The production of Sicilian sulphur reached its high-water mark in 1905, with a total of 570,000 metric tons for that year, as against 390,000 tons in 1881 and 112,000 tons in 1860; but after the conclusion of the agreement between the Consortium and the Union Sulphur Company, the production diminished, and in 1900 totaled only 400,000 tons. At the beginning of the present century the produc-

(Concluded on page 150.)

Sugar Beet Industry of Germany

What Science Has Done for a Great Industry

By H. C. Price

Germany is the home of the sugar beet industry. It has about 400 sugar factories, with a total average annual production of over 2,000,000 tons of sugar, about one half of which is exported. Sugar beet growing is the most profitable type of farming followed in Germany, and probably has done more than anything else to bring about the excellent type of intensive farming for which central Germany is so justly noted. The province of Saxony is in the heart of the sugar beet growing of Germany, and although it contains less than 10,000 square miles there are over 200 sugar factories in it. Good sugar beet land is worth $500 per acre, and the returns from sugar beet farming are large. This article is both a historical review and a summary of the technical methods that have elevated the sugar beet industry to its present eminence.—EDITOR.

THE beginning of the manufacture of sugar from beets is a direct result of the Napoleonic wars. In 1747, Marggraf, a German chemist, discovered that the common white field beet of Germany contained sugar, but this discovery was not considered as of any economic importance. But in the beginning of the nineteenth century, when Napoleon Bonaparte was in the zenith of his power, he put an embargo on the importation of sugar into Europe in order to strike a blow at England, since practically all of the sugar used in Europe came from the British colonies. This resulted in famine prices for sugar, and now for the first time Marggraf's discovery was thought to be of some economic value and that possibly the beet might be utilized as a source of sugar. As a result, in 1812 a factory, the first of its kind in the world, was built near Breslau, Germany, for the manufacture of sugar from beets. In France, likewise, factories were soon built, and under the stimulus of war prices and government protection the new industry was established.

Since 1890 the average annual world's production of beet sugar has exceeded the annual production of cane sugar, and in 1910 the world's production of beet sugar exceeded 8,500,000 tons, or seventeen billion pounds.

The development in so short a time of the sugar beet as a source of human food, is not equaled by any other plant anywhere in history.

Increase of the Sugar Content of the Beet.

In 1812, when the first sugar was manufactured from beets, it took twenty tons of beets to produce one ton of sugar, and at the present time it only requires about six tons. This decrease in the amount of beets required to produce one ton of sugar has been due to two things, (1) more perfect methods of manufacture, and (2) to a higher percentage content of sugar in the beet, principally to the latter. This increase of sugar content has been the result of scientific plant breeding, and the results that have been attained in this line are the most remarkable and economically the most important that have ever been accomplished through the science of plant breeding. Beginning with a plant that did not contain over 5 per cent of sugar, systematic selection by the plant breeder has produced a strain that sometimes contains as high as 25 per cent of sugar, and the average for an entire crop season in Germany has been as high as 17 per cent, as was the case in 1910.

That this immense increase in the sugar content has been the development principally of the last few decades is shown by the following table giving the percentage of sugar found in beets that were produced under the most favorable European conditions.

Percentage of Sugar Contained in Beets, by Decades.

Year.	Sugar.	Year.	Sugar.
1838.....	8.8%	1878.....	11.7%
1848.....	9.8%	1888.....	11.7%
1858.....	10.1%	1898.....	15.2%
1868.....	10.1%	1908.....	18.1%

In America equally high percentages of sugar have been secured, in some cases even higher.

Production of Beet Seed.

The sugar beet is especially well adapted to breeding, since a test can be made of the sugar content of the individual without destroying it for the production of seed. The beet is a biennial plant, making its growth the first season and the following year producing seed. In selecting beets for sugar content they are harvested in the fall, and in the laboratory a small section is bored out of each beet and tested for its sugar content. This shows the sugar content of the individual beet, and it is not injured for the production of seed the following spring. In this manner selections can be made from generation to generation, and pure strains and varieties established. Special beet breeding farms have been established in France and Germany where hundreds of thousands of individual beets are tested each year. The largest of these farms is at Klein Wanzleben in central Germany, where 12,000 acres are under cultivation and over fifty years beet breeding has been carried on under the most careful and scientific supervision.

The "plant" at Klein-Wanzleben, Germany, the largest beet breeding establishment in the world. The sugar factory, laboratories, seed warehouses and administration buildings.

Beet breeding laboratory at Klein-Wanzleben, Germany, for testing individual beets for sugar content.

Women harvesting beets. The type of laborers that are brought in from other provinces for the season.

Increase in Consumption of Sugar.

The world's consumption of sugar is now eight times as much as it was fifty years ago. From being regarded as a luxury, sugar has come to be a necessity in the every day diet of practically all civilized nations. It is the one product for which every individual seems to have a natural taste, and it is more generally liked by children than any other substance. The amount consumed varies greatly in the different countries, and as a rule is in proportion to the degree of civilization and average wealth of the nation. England and the United States have been far in the lead in the per capita consumption, as shown below, and are the heaviest importers.

Per Capita Consumption of Sugar in Pounds Per Annum.

England	89.5
United States	74.8
Switzerland	58.1
Denmark	56.7
Norway and Sweden	41.7
Holland	38.0
Austria-Hungary	37.2
Germany	36.9
France	36.0
Belgium	27.9
Russia	16.6
Spain	10.2
Turkey	8.2
Italy	7.7

There is no distinguishable difference between beet sugar and cane sugar as they appear on the market. They are entirely interchangeable, and the only determining factor in their use is the price at which they are sold. Although the production of cane sugar has increased rapidly, beet sugar production has advanced with a much greater rate of speed until now over one half the world's supply comes from beets. The increase in the world's production and the relative amount produced from sugar cane and from sugar beets during the last fifty years is shown in the following table:

World's Production of Cane and Beet Sugar in 1,000 Tons.

Year.	Cane.	Beet.	Total.	Proportion Beet Sugar.
1860..	1,376	390	1,766	22.1
1870..	1,856	844	2,700	31.3
1880..	2,084	1,531	3,615	42.4
1890..	2,522	3,537	6,059	58.4
1900..	2,978	5,440	8,418	64.6
1910..	6,236	8,471	14,707	57.6

The Labor Problem in Sugar Beet Culture.

The greatest drawback to the growing of sugar beets in America has been the labor problem. A large amount of hand labor is required, and in America this labor has not been available. In Germany it is done largely by women. According to the census of 1905 there were 5,500,000 farm hands in Germany, exclusive of the owners of the farms, and their families, and of this number 2,500,000 were women.

(Concluded on page 151.)

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Stagmatypy and Spitzertypy

To the Editor of the SCIENTIFIC AMERICAN:

In connection with the article on "Stagmatypy," in the SCIENTIFIC AMERICAN for July 13th, the process of photogravure for which a German patent was issued to Dr. Spitzer in 1905 should be of interest.

In spitzertypy the coating of the plate consists of a mixture of 20 to 30 per cent albumin or gelatin in water with 3 to 6 per cent of dichromate. The coated plate has no grain. After printing, the plate is etched in a solution of ferric chloride (sp. gr. 30 to 40 deg. Bé.). As in stagmatypy, granulation develops during the etching.

The results of Spitzer's process are remarkable for the faithfulness with which details are rendered. A number of cuts made by the process are shown in *Photographische Korrespondenz* for 1905, page 473.

Spitzer's German patent is No. 161,911, patented December 10th, 1901; issued July 7th, 1905.

Washington, D. C. BENJAMIN B. SCHNEIDER.

Danger of Bow-on Collision

To the Editor of the SCIENTIFIC AMERICAN:

Your recent editorial on the "Titanic" reminds me to repeat to you what I wrote to the chairman of the "Titanic" Investigating Committee, but have not seen noticed in any newspaper.

When a large ship, like "Titanic," moving swiftly, strikes a large iceberg, the principal danger and the principal damage would *not* be in the crumpling of the bow or the flooding of several compartments, but in the behavior of the boilers and secondary to that the behavior of the engines.

When the forward motion of the ship is suddenly stopped nothing whatever could hold boilers and engines from breaking loose and going forward and smashing the bulkheads and probably the bottoms.

But in addition to this the boilers must break the steam pipes and must immediately explode, and this would destroy the ship.

This is submitted to your consideration, although it may be old. W. S. PROSSER.

San Jose, Cal.

[In his testimony at the Board of Trade Inquiry, London, the designer of the "Titanic" stated that if the ship had struck bows on, she would have crumpled up about 100 feet of her bow and would have taken several seconds to come to a state of rest. He stated further that the blow would have been so greatly cushioned that the machinery would not have been displaced.—EDITOR.]

A Word to the Socially Unfit

To the Editor of the SCIENTIFIC AMERICAN:

Kindly allow me to say a few words suggested by your editorial entitled "Lunacy and Morals," in your issue of July 13th.

From the deterministic, the only thoroughly scientific standpoint, there is no "line separating responsible wickedness from acts against the public peace which have their origin in perversities of the psychic apparatus." Both result from peculiarites of structure, physical or psychical, which are often as much beyond the reach of medicine or surgery as they are beyond the reach of the subject himself.

Now that the old conception of punishment as social revenge has died out, in theory at least, the question is no longer whether one who is a public menace is "insane" or "immoral." The point is that he is a diseased element in the social organism, and as such should be removed. Scientifically speaking, a man is no more to be blamed for crime than for insanity. With the odds overwhelmingly against the man who oversteps the bounds of social conduct, as they are, he who does overstep those bounds reveals a weakness either of judgment or of self-control, both of which are allied to other forms of mental weakness. This, aside from the fact that the "perversion of the moral sense" is either congenital or the result of early influences.

The fault of the newer humanitarianism is not that it "now holds extreme views as to irresponsibility for criminal acts," but that it does not recognize that to declare a man to be insane does not make him less a social menace nor does it alter the fact that he has become what he is by the action of laws beyond his control. Neither does it alter the fact that the health of the social organism demands that he be removed therefrom, and removed effectually.

On this point the altruism which has done so much for our western civilization has degenerated into a harmful sentimentalism which places an excessive value upon the mere form of human life, regardless of the worth of that life to itself or to society. We take better care of our idiots, lunatics, and criminals than we do of our children. The last are left to chance until they become idiots, lunatics, or criminals, when they begin to receive the attention which comes too late. A rational and truly humanitarian policy would be to eliminate these elements by a painless death, which would end many miseries, protect society, and purify the social atmosphere. Vast energies would thus be left free to attack the problem of social regeneration at its root, the children. The social organism can never know its own possibilities until it has given every child an opportunity to grow up under the best possible conditions, physical, educational, and ethical, and it is time that public solicitude shifted more in this direction. PAUL R. BIRGE.

Washington, D. C.

A Manufacturer's Views of Patents

To the Editor of the SCIENTIFIC AMERICAN:

Noticing in the papers that when Mr. Samuel O. Edmunds of New York city appeared before the Committee on Patents, he advocated making the date of filing the application on an invention the test of priority of the invention.

This might further the interest of justice in some rare cases, but I believe on the whole it would be a grievous mistake. It would result in the taking out of patents on thousands of unperfected, and consequently useless inventions. The theory of our present law is that unless the invention on a machine is something that will actually do the work intended, the patent is invalid. The theory is that the specifications and drawings shall show enough, so that a man with ordinary mechanical skill in the line to which the patent pertains may be able to construct a useful and operative machine.

If the original inventor did not apply for a patent on his first crude conceptions when he began experimenting, he would have to do everything under lock and key, and would always be in danger of having his conceptions patented by someone who found out what he was working on, so as to bar him from using it after he got it perfected.

It always takes a year, and usually two years, for me to make a material change in one of my machines. The change I am now making I have worked on steadily for three years, assisted by a corps of expert mechanics, during which time I have built over twenty models in reducing it to a practical and useful state of perfection. Under the present law I can do the work in the open, and have no fear of anyone stealing my invention

I have been through a number of interference proceedings, and while they are expensive and annoying, I do not see any better way for insuring justice to all.

Sometimes I have grave doubts as to whether it is really very common to buy inventions for the purpose of suppressing them. It is true that concerns who have a large amount of money invested in special machinery and plant for the manufacture of a particular article, would be loath to make a change in that article which would involve a further large investment in tools and special machinery and the scrapping of a large portion of their original investment in this line. Perhaps a more serious determent is the fact that a change always involves the necessity of re-educating the staff and working forces to the production of something entirely new, during which period an inferior product is turned out and perhaps the reputation of the firm seriously injured. Also oftentimes things which, after long and careful testing, and which, viewed from every standpoint, appear to be practical, when put on the market, for some reason prove to be inferior to the original device. This is something that can scarcely ever be determined with a certainty until after some months or years in the field.

The fact that nearly all manufacturers of specialties, particularly those protected by patents, maintain expensive experimental departments, would tend to negative the theory that as a rule they desire to suppress new inventions. All such manufacturers receive weekly offers to sell patents on articles in their line or proposed improvements on their devices. Few, if any, offers are based on anything of any value whatever, and most of them have for their basis some impractical idea which has been offered by hundreds of others. There is one alleged improvement in the comptometer which has been offered to us on an average of once a week. This idea was tried out and discarded over twenty years ago and has since appeared in hundreds of adding and calculating machine patents. I have tried it out exhaustively on three separate occasions. Another was patented over twenty years ago. I manufactured it for a time, and found it to be of more damage than benefit. Yet continually I receive letters from men who think they have invented one or the other of these things, and that I am depriving the world of a great boon in refusing to turn over to them a factory and organization that has taken twenty-five years to build up, for the purpose of perfecting and putting their inventions on the market.

It would be utterly futile to try to explain to them why their ideas are impractical, and if one attempted to do so he would have time for nothing else, besides he would not succeed in convincing them. There was never yet suggested to me anything that I had not already considered and usually tried out exhaustively. I never bought any patent. Many a man has left my office with the statement that he was going after my scalp or that I would some day overlook a great opportunity by pursuing the course I do, only to some years after ask me to buy the machinery which he had purchased for the purpose of perfecting the manufacture of his supposed invention. If I had originally purchased his patent, he would always have believed that the purchase was only to suppress it. That class of inventor usually has little to do, so has time to make a good deal of noise, and a great many receive their statements at face value, hence the popular idea about buying up a patent to suppress it. Some manufacturers make a practice of buying up patents, but I do not believe that often they ever buy up anything of real merit for the purpose of suppressing it.

The cost of selling a patented article usually exceeds by far the cost of manufacturing. The public in its turn is very conservative, and as a rule all very meritorious inventions have to be forced onto the public—their introduction involves a tremendous amount of education. I believe that it is in this respect that patents have been beneficial to the public—much more so than from the tendency of our patent laws to encourage invention. If Congress should pass a law giving some firm the exclusive right to publish books treating of the method and use of the metric system and the exclusive right to make instruments for measuring and weighing by the metric system, in twenty years we would all be enjoying its benefits. As it is, no one can afford to introduce it, and Congress does not see fit to make its use compulsory.

It has been said that the greatest boon conferred on Christendom was conferred by Gerbert when, after disguising himself as a Mohammedan, he succeeded in obtaining admission to the Moorish universities, and after passing through two of them, returned into Christian Europe, bringing with him Arabic numerals. No one had a patent on their use, and for several hundred years they were not universally adopted, and school children could not be taught multiplication and division except in the small factors, which could be computed by mental perception with the use of pencil and paper. During that time, for business and engineering computations, everything was computed by the use of the abacus, such as is used by the Chinese and Russians to-day.

No one can question the valtie to mankind of the potato. Numerous explorers brought back to France, England, and Spain samples of the potato shortly after the discovery of America, but it was several hundred years before it became a common article of food, in spite of numerous recommendations by various great authorities that it be generally cultivated.

I do not believe a patent should be issued for any long period of time. I believe that seventeen years is about right. For some things the period is too short to enable those exploiting it to overcome the inertia of the public and reap any material benefits from the long years of labor, but no law can be so formed as to fit every possible case. What appear to be the most revolutionary inventions should be partly accredited to the inventor who first makes them practical and partly to the general advance in the mechanical arts. Seldom if ever has a revolutionary invention been brought out that has not been conceived and an attempt made to put it in material form hundreds of times before, only to fail either because the inventor has not the ability to perfect it or else mechanical arts are not advanced to a point where it could be successfully and economically manufactured.

Were it not for wars requiring the simultaneous manufacturing of large quantities of weapons, the sewing machine and the typewriter could never have been manufactured at a cost which would have made their purchase and use advisable. The machinery which has been evolved after many years for the manufacture of weapons had to be developed to a high point of efficiency before sewing machines and typewriters could be manufactured in large quantities and at a low cost. I can cite numerous other illustrations of this fact.

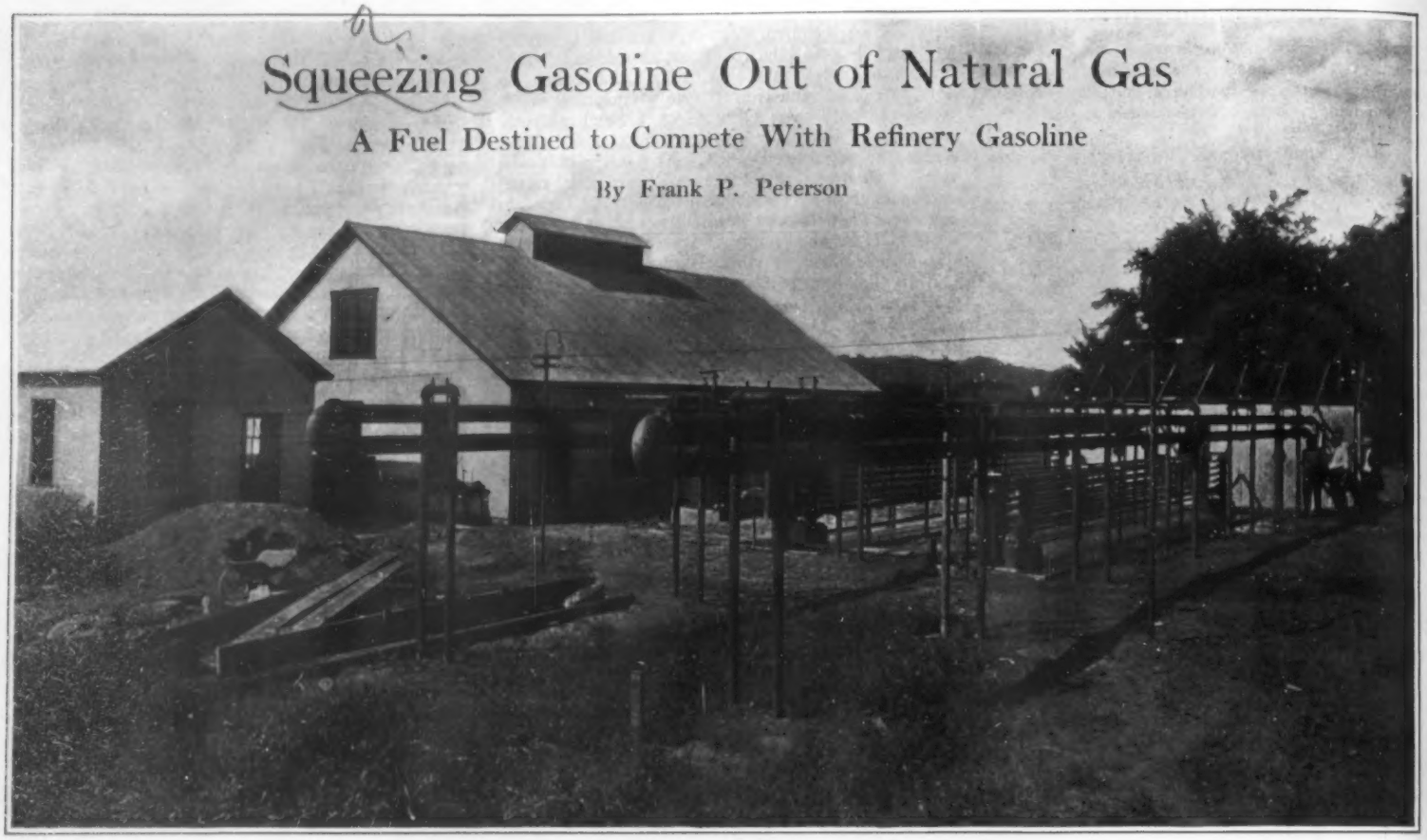
It is a serious question whether or not the one who pioneers a new art or invention does the public such a great injustice, even when he buys other inventions in the same line. The expense of pioneering is so great, that unless he has reasonable assurance of a monopoly which will warrant him in incurring the enormous expense of pioneering, he cannot afford to take the risk. I believe that a careful analysis will demonstrate that in those lines where a patent monopoly is the most complete, the public has received the most benefits and enjoys the most advantages in the way of improvement in quality of manufactured product.

Chicago, Ill. D. E. FELT.

Squeezing Gasoline Out of Natural Gas

A Fuel Destined to Compete With Refinery Gasoline

By Frank P. Peterson



THE refining of petroleum oils as an art has been subject to a peculiar diversity of limitations. The infinite variety in physical characteristics of the crude oils which have been unearthed have imposed those limitations.

Crude oil may mean anything from an approach to asphaltum in character to the other extreme. An example representing the one extreme would be a dark brown or almost black substance having a pungent odor, the consistency of a thick molasses and a specific gravity of slightly more than 1.000 as compared to water. A sample representing the other extreme would have a slight discoloration, only, from a pure white, and would be comparable in general appearance to the very lightest of sewing machine oils. So much for the liquid petroleum products which Nature has deposited for us.

In the majority of instances where petroleum is found, it is accompanied by more or less extensive deposits of natural gas. There are some exceptions in which petroleum is found alone. There are a great many cases in which gas is found not accompanied by petroleum, and many instances in which it cannot be shown that there is any physical connection between deposits of gas and oil.

It is an interesting but not greatly surprising fact that gases which are found residing with petroleum oils in the earth vary in physical characteristics almost as widely as do the oils which form the great family of liquid petroleum deposits; this with reference to specific gravity and variance of the relative percentages of the different hydrocarbon compounds of which the gas is composed.

Until about two years ago natural gases were estimated commercially as methane. It is a fact that the great volume of gas being produced and transported to large consuming centers may be so classed without great deviation from strict truth. Probably as much as 90 per cent by volume of the gas composition is methane, the remainder being ethane with very slight percentages in some cases of propane.

In dealing, however, with the gases which are found directly accompanying the petroleum oils as they reside in the strata from which they are obtained, we have a very different condition and a widely different general composition of gas. It is thought, now, that the variance in gas composition in adjacent oil wells is much greater than is that of the oils. Wells located within a narrow radius and producing, so far as can be observed, oils of uniform character from the different wells will produce gases which vary very markedly in percentages of the different hydrocarbons of which they are composed.

Within the last two years, a development has been carried to the proportions of an industry allied to refining, but which becomes necessarily a part of oil field operations, and it consists in the recovery of a refined gasoline which is extracted from oil well gases at the wells. There are a few exceptions to the statement that this product can be recovered from oil well gases only, but the writer believes that without exception it can be demonstrated that any gases which yield gasoline condensates to any considerable extent, communicate to and through oil producing strata. Since this phase of the petroleum industry has reached commercial proportions amounting to the recovery of probably some 2,000 barrels daily of a product which heretofore had gone to waste, it would be interesting to look into the physical conditions which make it possible. It will be most convenient to deal with the series of hydrocarbons known as saturated paraffins. It is possible that there may also be some exceptions to this latter classification.

Like most new things "natural gas gasoline" is the product of an imagination. For years it had been noticed that gasoline collected in the pipes into which the waste gases of oil wells had been turned. This "drip" was bought up by refineries. An imaginative inventor, John Lathrop Gray, made up his mind that he would find out why the "drip" accumulated at all. He found that gasoline could be squeezed out of natural gas, and took out the only patent which comprehensively covers the process now most widely used. This article, written by one intimately connected with the industry, explains the scientific principles of recovering gasoline from oil well gases.—EDITOR.

If we consider, however, that a triangle may graphically represent the great family of saturated petroleum hydrocarbons, we can divide such a figure into percentages which may represent to the mind's eye, very clearly, the summary of facts involved.

We shall not permit the figure, or the percentages into which we divide it, to represent wholly relative volumes, but rather to represent combined volume and composition with reference to the structures forming the great group or family of petroleum hydrocarbons.

The dark base on which the triangle rests may represent the coke residue drawn from a petroleum still after the crude has been distilled into its various fractions; the second small percentage section of the triangle will represent petroleum tar and paraffin waxes; the third section, varying greatly in volume, may represent greases and lubricants; the fourth division may be made to represent lighting oils; the fifth, to represent naphthas; the sixth, to represent gasoline fractions; the seventh, to represent refinery products known as pentane, rhigolene, and cymogene. The eighth, to represent the heavy portions of condensible natural gases with which this article attempts to deal. The ninth division may be made to represent that portion of heavy gases which is intermediate between the product commercially accepted as gasoline and the great volume of gas product known as dry gas. The tenth and last division will be made to represent the methane portion, together with any impurities, of petroleum deposits, where gas and oil may be found in large volume. Such impurities as may be worthy of mention are carbon dioxide, free nitrogen, and some hydrogen sulphides.

To get a familiar conception of the chemical proportion of the compounds forming the triangular graphic representation, we may go to its base and look for a composition which is almost wholly carbon. The next division of the triangle will represent a product having a greater percentage of hydrogen and a lesser percentage of carbon in its make up, and when we have arrived at the third, or grease and lubricant division, we begin to find chemical compositions like C_{24} H_{50} of the saturated series having the general form C_n $H_{2n}+2$. The sixth group will bring us to a chemical composition with which we are quite familiar, viz., C_8 H_{18}, gasoline, naphtha, benzine. The seventh group will still further lower the relative carbon proportion, and we will have a range of compounds running from C_6 H_{14} to C_5 H_{12}. The eighth division will represent our natural gas gasolines which are so closely related to the seventh group that it is not proper to designate them as different except as exceptions to this phase of the petroleum industry which we are considering now. The ninth group or division is to play an important future part in our domestic life. It represents that very considerable fraction of the greater number of oil well gases which can be liquefied by reasonable treatment and delivered in strong steel containers to isolated consumers for fuel and lighting purposes. The tenth and final division is C H_4 with the above-mentioned impurities, which exist to varying degrees in different localities, and are absent in the great majority of the important producing regions.

In getting a proper conception of this interesting matter, it must be borne in mind that the groups or divisions of petroleum products, unless subjected to extremely tedious treatment, are not sharply defined in chemical composition. This fact may be graphically represented again by the hypotenuse side of the triangle, which might represent the gradation from a hydrocarbon structure through all the minute steps from an all-carbon to an all-hydrogen composition, the hydrogen point being represented by the vortex of the triangle.

It is now easy to refer to and explain the method by which the product which is known as "natural gas gasoline" is recovered. For many years past in the operation of oil wells, where the gases escaping from them have been turned into a system of pipe lines for service, and the running of gas engines used to pump the wells, difficulty has been experienced under favorable winter weather conditions in those lines becoming filled with a liquid. Some water is frequently present, but more frequently the liquid found in the pipe lines

is seen to be gasoline. Many oil operations collect considerable quantities during the winter season of this "drip" product, which has been bought up by the refineries as an inferior grade of gasoline. It obtained its reputation of inferiority from the fact that, in many cases, having lain in rusty pipes and come in contact with oil and dirty paraffin sediments, it has been discolored and required filtering or redistillation. The oil producer has, therefore, been content to receive something like one fourth to one third the prevailing market price for gasoline for his "drip" product, even though it be water white, and of apparently high grade as compared to refinery gasoline.

The physical laws involved in the process of recovering gasoline from natural gas are supposedly very simple. They would appear to be the same as for the condensation of any liquid vapor suspended in a gaseous medium. The fact, however, develops that the suspended vapors present in natural gas being of three or four different chemical groupings complicate the matter somewhat and bring about the requirement of more extensive treatment than the first glance would perceive as necessary. Compressing and cooling of the gases containing the vapors in suspension is all that is necessary, provided the same be carried to a sufficient extent and effected under proper arrangement for the separating of the liquid to be precipitated.

Going back to about the year 1906, we find a few investigators going further into the matter than the application of vacuum to oil wells, and the recovery of the "drip" from lines connecting the pumps used to produce vacuum on the wells. They were employing air compressors to compress the gas to an extent much beyond that for which oil well vacuum pumps are designed to do duty. John Lathrop Gray obtained, apparently, the only patent which comprehensively covers the process, and the licensees under that patent seem to have found the most effective and extensive development of the industry.

The essentials of this Gray patent are the compressing and cooling of the gases, the separation of liquid products and the accomplishment of the same by the simplest and most effective means.

Gray used a simple type of separator for collecting the condensates, and an automatic trap which continually transferred the condensate to a place of storage.

The advantageous features of the method are greater than are seen at the first glance. One great difficulty in the development of the art has been to reduce the condensates to such a state of stability as will eliminate serious evaporation losses between points of production and consumption. It is now known that gasoline, either from petroleum oil or gas, will absorb considerable quantities of gas or even air, and that the absorption is a function of time, temperature and pressure.

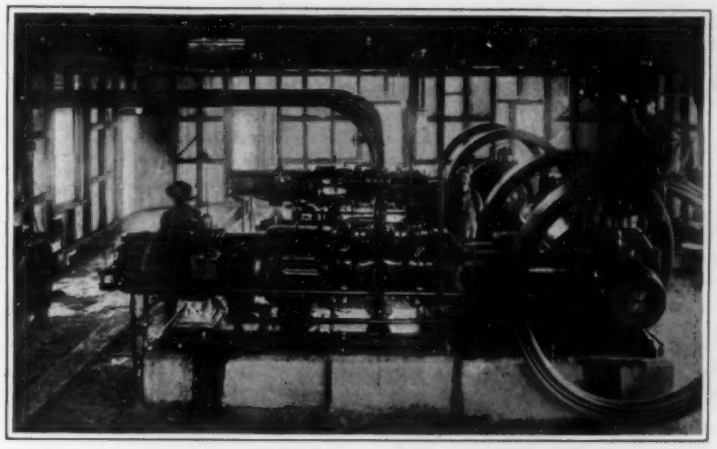
Gray's method, therefore, of using traps to remove the condensates promptly, when precipitated, and minimizing the time of their exposure to gas under pressure, is of the utmost importance.

Just as in the case of crude petroleum oils, the new product, when produced by Gray's process, is capable of refinement to more homogeneous fractions. When to be handled as gasoline, the new product is very much improved by the removal of that portion embodied in a fraction which is too light and volatile to be stable at atmospheric pressure and the temperature conditions which must be met in use.

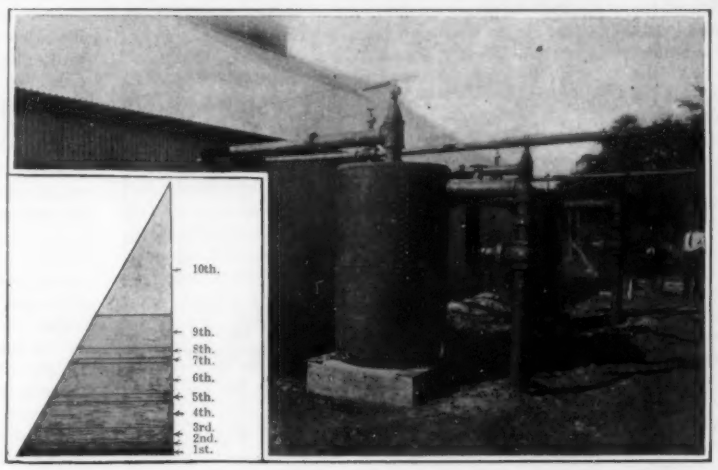
The recognition of new uses and increasing demand for the conservation of all fuel energy has held the promoters of the new industry to a realization of the necessity in providing means to effect the recovery and the separation into commercial fractions of the total product available. The possibility of fractionation by stage compression was early recognized by the writer, and many installations of machinery capable of ready adaptation to this method have been accomplished by the firm of manufacturers which has given the industry its greatest uplift.

The possibility of separation by stage compression treatment of a relatively large fraction of the product suitable for any fuel purpose, but which must be handled under restraint, brings about an entirely new phase of the petroleum industry which has not yet had scarcely more than an introduction to scientific and technical notice.

The successful introduction of the new product, which has been accepted as gasoline, depended largely on market conditions. It is comparable in inflammable



The squeezers—direct driven straight line gas compressors, using for fuel residue gas after gasoline has been extracted.



Receiving tanks, in which the gases from oil wells are collected.

The insert shows triangle representing the great petroleum family. Taking out the 8th group which represents the heavy portions condensible to gasoline, the remaining residues are: 1st.—Petroleum Coke. 2nd.—Petroleum Tar and Wax. 3rd.—Greases and Lubricants. 4th.—Lighting Oils. 5th.—Naphtha. 6th.—Gasoline. 7th.—Refining products, Pentane, Rhig - lene, Cyomogene. 9th.—Intermediate heavy gases. 10th.—Methane.

Air and water cooled coils used in the condensing system.

prices of all petroleum products. The refiners were able to offer their product in serious competition with the new natural gas condensates to the extent of largely shutting its recognition out from the consumer.

The new product finds its best adaptation in the treatment of the refinery low grade gasoline fractions to make them suitable for motor fuels. Apparently, the new product will be sufficiently plentiful to bring the entire petroleum naphtha fraction, which is too low in gravity for successful motor fuel, into a state of volatility making it entirely satisfactory, so far as carburetion and proper fuel mixture is concerned, and when so enlivened, this particular naphtha fraction has the greatest fuel value, having a greater weight for equal carbureting characteristics than any other known fuel.

The new product in appearance and physical characteristics is so nearly identical with the refinery first fractions, when properly produced and treated, that it requires careful judgment to distinguish it. The gravities of the natural gas condensates range from 76 degrees to 100 degrees Baumé (sp. gr. 0.68 to 0.61). It mixes permanently and without stratification with any refinery product which is not technically termed an oil. It also will mix sufficiently well with kerosene or lighting oil fractions to make a good satisfactory motor fuel, though, of course, such a mixture is not suitable for the cleaning of delicate fabrics where the presence of an oil would be objectionable. The term blending has been erroneously but conveniently adopted. The term itself would indicate the bringing together of two non-miscible materials. The light condensate is perfectly miscible with any "dry" or naphtha fraction and cannot be separated or re-obtained except by fractional distillation, and then only imperfectly.

The necessity for maintaining a cheap source of motor fuel will soon bring about the practice of "blending" the new "natural gasoline" or gas condensate with a 46 to 54 gravity lighting oil. Such a product will not be recognized or given proper credit, however, until the price of motor fuels makes it necessary to resort to such a means.

The very remarkable increase in motor fuel consumption which goes on is destined, however, to bring about revolution and the adoption of any new thing which can safeguard the consumer against prohibitive fuel cost.

For the question stands unanswered today, just as it has for forty years, have we reached our maximum crude oil production?

The advance in prices of the fuel fractions for this season alone is sufficient to warn us for the coming consequences when we do reach the zenith. We may as well assume that we are going to reach it one of these days, and take a few forethoughts as to what actually can be done to conserve the petroleum resources. We do not at all fully appreciate the importance of our petroleum, nor are any of us prepared to say what could be found to substitute it, were it no longer available.

If we go back to the graphical triangular representation of petroleum, which, being hurriedly drawn, makes no claim to precision, but can be counted upon to represent facts as roughly and about as closely as a quick conception could state them, we will see how great is the division in favor of fuels. For, beginning with the fourth group, everything upward is consumed either to heat us, move us, or light us.

If we look at the combined sixth, seventh, and eighth groups, and consider them as adapted to gasoline motors, then consider the number and extent of these motors; and if we look at the tenth division, representing natural gas, and consider that Buffalo, Erie, Cleveland, Cincinnati, Pittsburgh, practically all the intervening area and much surrounding, represents possibly one half the natural gas consumption; that all these communities depending on natural gas have reasonable expectation of many years of service, we get a good comparative idea of space nine, which represents what is being wasted, what has always been wasted throughout the life of the crude oil industry.

characteristics to the highest grade refinery gasolines, and since its bulk has reached considerable proportions, the transportation of the same has received the attention of the Bureau of Explosives, and finally the Interstate Commerce Commission with certain restrictive safeguards which have placed its utilization at a premium, and the industry has been able to thrive only under the conditions of the consumers' demand which prevailed in 1910, and which now prevail. The whole year 1911 was one of plenty and predominant low

The Flight of Projectiles—II

The Actual Positions of a Shell from Gun to Target

By Rear-Admiral N. C. Twining, U. S. N., Chief of the Bureau of Ordnance

Reproduction of Motions.

IN 1911 the Bureau of Ordnance of the Navy Department made a small model projectile and suspended it on gimbals. The projectile was then rotated at a speed of 3,000 to 5,000 revolutions per minute (being about the speed of rotation of a large-caliber projectile). To simulate the air resistance in flight, a blast of air was directed against the rotating projectile, and the behavior of this projectile confirmed the theory in all respects. As soon as the blast of air was directed against the rotating projectile, the projectile began to precess about the direction of the air. As the blast of air was changed in direction to simulate the changing direction of the resistance in flight, the projectile's axis depressed to meet the new direction of the air blast.

A similar demonstration can be made with an ordinary gyroscope. With care in manipulation the partial precessions made by a projectile can be simulated.

Penetration of Armor.

It is evident, even to the lay mind, that if projectiles struck with their axes not in the trajectory, penetration of armor would be almost impossible. This will be evident from an inspection of sketch No. 6.

The forward part of the projectile would strike first, but as the point of the projectile is not moving in the direction of the trajectory, there would be a tremendously powerful moment forcing the projectile broadside against the armor. Practically no harm would be done to the armor, and the projectile, being forced at high velocity broadside against the armor, would be broken up.

The fact that armor has not more often been pierced in naval battles is used by those who believe the shell does not strike point on as a proof that their theory is correct. They argue that if the projectile struck point on, the armor would be pierced.

The small number of armor penetrations in naval battles is due to a number of causes.

First. The armored part of a vessel is but a small part of the whole target, and, therefore, of the relatively small number of hits that have been made in naval engagements, only a few have been made against armor.

Second. Frequently high explosive shells, with thin walls and sensitive fuses, have been used in naval battles, and these projectiles on striking armor will break up or explode without penetrating, as such projectiles are not designed for penetrating armor.

Third. Even with well-designed armor-piercing projectiles complete penetration is not likely when the projectile but slightly overmatches the armor, unless the impact is not far from normal. Projectiles striking armor at an angle of more than about 10 degrees from normal are subjected to severe cross-breaking stresses, as will be seen from sketch No. 7.

It is not expected that penetration will be secured under such conditions without the breaking up of the projectile, unless the projectile considerably overmatches the armor.

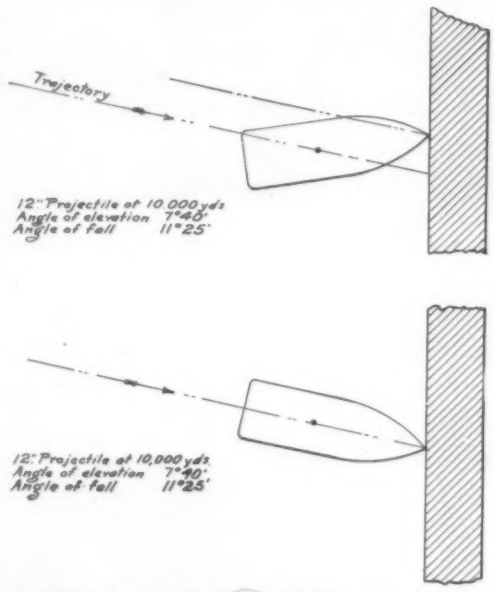
It is due mainly to the foregoing causes that armor penetrations have not been more frequent in naval battles. To demonstrate, however, that penetration will occur at battle ranges, and to further demonstrate that the projectile does travel with its axis in the trajectory, the Bureau of Ordnance of the Navy Department, in 1911, conducted a series of firings against modern 8-inch and 10-inch armor. Three hits were made at a range of 7,800 yards; one in an 8-inch plate, and two in a 10-inch plate. All three projectiles penetrated the armor, leaving clean, round holes. The evidence was conclusive not only that the projectile traveled with its axis in the trajectory, but that modern armor could successfully be penetrated at battle ranges, and that the data obtained from short-range firings at the proving grounds could be applied equally well to long-range firing.

Retardation of Velocity.

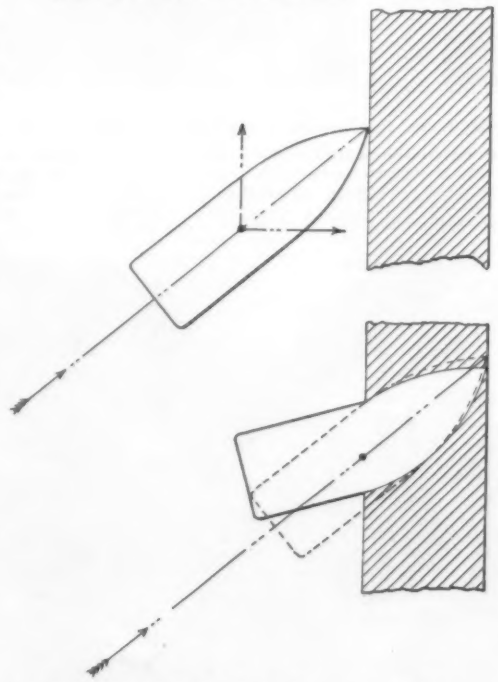
There is another proof that projectiles in flight must travel nearly point on. It is evident that the retardation of the projectile, due to resistance of the air, must be much less when the projectile is moving point on than when it is moving considerably inclined to the trajectory, as in sketch No. 2. In the latter half of this trajectory (see first article) the area on which the air pressure acts has so greatly increased over that in the first part of the trajectory that the velocity of the projectile toward the end of the range would fall off very rapidly. It is found from actual firing, however, that the retardation of velocity in the latter part of the trajectory is actually somewhat less than the retardation in the first part. This means, of course, that the projectile must travel practically point on throughout its flight. The ranges obtained from actual firings do not vary more than one or two per cent from the ranges calculated by assuming that the projectiles travel, throughout their flight, point first.

Explanation of Drift.

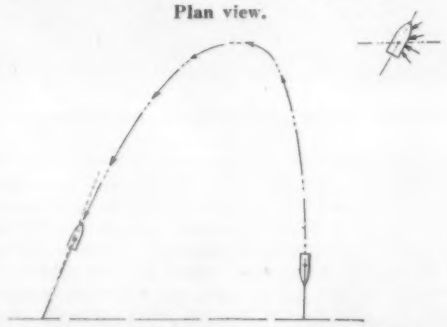
It is found that all projectiles having right-handed twist drift to the right. This is exactly opposite to the drift or curve of a baseball, which with a right-handed twist drifts to the left. The explanation of the left-handed drift of the baseball is simple. The air, rotating with the baseball, banks up on the right side against the still air to a greater degree than it does on the left side, and the resultant reaction of the air against the baseball deviates the baseball to the left. There is a similar effect occurring in projectiles, but it is very small, and the drift of projectiles is due to other causes.



Sketch No. 6.—The upper drawing shows the supposed and the lower drawing the actual position of projectile when it reaches the plate.



Sketch No. 7.—Inclined attack on armor plate.



Sketch No. 8.—Showing the path of a mortar shell, which reaches the target point down.

The rotating projectile is continually describing partial precessions, the point of the projectile being practically always slightly to the right of the vertical plane of the trajectory. It is evident, therefore, that there is a small component of the air resistance which translates the projectile to the right. This is the dominant element in causing deviation in projectiles, and projectiles with right-handed twist drift to the right.

In addition, there is the effect of the frictional couple, which assists in moving the projectile bodily to the right.

If the axis of the projectile remains parallel to the original direction, as in sketch No. 2, it would be difficult, if not impossible, to account for the drift of the projectile. If it is maintained that the projectile remains parallel to its original direction, none but frictional forces could give the projectile deviation, and these forces would decrease with the range; consequently, the rate of drift would fall off as the range increased. Exactly the reverse takes place in firing projectiles, the drift increasing very rapidly with increase of range. This increase of drift is occasioned principally by the fact that the amplitude of the precessions increases as the range increases; that is, the point of the projectile deviates farther from the trajectory. The resulting component of the air resistance, which translates the projectile bodily to the right, is therefore stronger, and as the velocity of the projectile is being continually lessened, the drift increases rapidly.

High-angle Fire.

In high-angle fire it is very necessary, in order to ensure accuracy, that the projectile fall point first. As the angle of elevation increases the axis of the projectile must turn through larger and larger angles, in order to descend point first, and the greater part of this change of direction has to be made in traveling a relatively short distance near the top of the trajectory. This will be evident from an inspection of sketch No. 8.

Those who believe in sketch No. 2 would predict that all projectiles fired at high elevations would fall base first. Yet, all records and data show that these projectiles fall point first until angles of elevation of more than 70 degrees are reached. If fired at elevations exceeding 70 degrees, projectiles may fall base first, as will be clear by reference to sketch No. 8. It should be understood that the angles mentioned vary somewhat, and depend on the projectile used, its velocity, and its speed of rotation. In general, for high-angle fire a fairly low rotation is used (1,500 to 4,000 revolutions per minute), in order that the projectile may respond quickly and fall point first. As low velocities are used for high-angle fire, a low speed of rotation will ensure stability. It can readily be seen from sketch No. 8 that if a projectile has a high speed of rotation, and, consequently, a precession of slow rate, and small amplitude, there will be a definite angle of elevation for that projectile, such that when the projectile reaches the top of its trajectory the direction of the air resistance will change faster than the tendency of the point to follow. It should be borne in mind that owing to the low velocity of the projectile at the top of its trajectory, the gyroscopic moment is very small, even although the lever arm increases rapidly with the change of direction of the air resistance. The gyroscopic moment being relatively small, the projectile changes the direction of its axis very slowly. As the point of the projectile dips and tends to follow the rapidly-changing direction of the air resistance, it lags behind in this movement. There soon comes a time when the direction of the air resistance is broadside to the projectile and directly through the center of gravity. At this point the projectile has no tendency to precess, and travels broadside through the air, the precession practically vanishing. As the projectile approaches the descending branch of the trajectory the air resistance falls below the center of gravity. The direction of the air resistance is now upward, and the point of application of this resistance is in the lower part of the projectile. This tends to start a precession of the projectile with the base of the projectile precessing around the air resistance. That is, the base of the projectile tends to come over to meet the line of the air resistance, and thereafter the projectile falls base first. The angle of

elevation beyond which the projectile falls base first is reached sooner in proportion as the speed of rotation is increased, the projectile shortened, and the velocity decreased.

In May, 1912, five 12-inch projectiles were fired from United States Army mortars at an angle of elevation of 65 degrees. The observing party consisted of four officers and three enlisted men. All five projectiles were seen in the descending branch of the trajectory, falling point down. The results of this firing confirmed data previously obtained from similar firings.

Satisfactory firing has also been obtained at angles as great as 70 degrees, though it is found that the drift of the projectile is likely to be irregular at this elevation.

The angle of elevation which decides whether the projectile will fall point first, or base first, depends to such an extent on the variables previously mentioned that it is not possible to state more than that for the conditions under which mortars are fired the angle is probably not much greater than 70 degrees. Mortar fire is usually limited to angles of elevation of 65 degrees.

Authorities.

A large number of scientific authorities might be quoted, all of whom are believers in sketch No. 1. The eminent German authority, Prof. Cranz, and the eminent British authorities, Prof. Greenhill and Prof. Henderson, have demonstrated that the axis of a projectile remains sensibly tangent to its trajectory. Brig.-Gen. William Crozier, Chief of the Ordnance Department of the U. S. Army, also maintains the correctness of sketch No. 1. There is not an authority in any country who maintains the correctness of sketch No. 2.

It should be understood that the foregoing discussion of the flight of projectiles is complete only in so far as pertains to the object of this article. No mention has been made of the nutations described by the point of the projectile, or of the motions occasioned by forces impressed on the projectile on leaving the gun. There is much information that could be given on the action of the air resistance, the effects of various riflings, etc., but none of these have more than an indirect bearing on the subject, and do not change in any way the deductions in this article.

It is believed that the credence given to sketch No. 2 has been due wholly to popular misconception, and it is hoped that sufficient data have been presented in this article satisfactorily to establish the fact that a rotating projectile in flight must have its axis at all times sensibly tangent to the trajectory.

High Temperatures and the Electric Furnace

The Different Types of Electric Furnaces

By Prof. Joseph W. Richards, Lehigh University

WITHIN the last twenty years, electrically-generated heat has been a favorite topic of discussion among chemists and metallurgists, and the possibilities of using it industrially are attracting great attention. Various types of electric furnaces have been devised and put in operation, for such various purposes as producing pig iron, melting steel, melting brass and bronze, making silicon carbide, calcium carbide, titanium carbide, converting ordinary carbon into graphite, melting quartz, fusing glass, reducing tin ores, melting gold and silver precipitates, converting nitrogen and oxygen in the air into nitric acid. In fact, the uses of electric furnaces have become so various that a large-sized book can easily be written about it, and several such are already in print in the German, French and English languages. Any bookseller, or importer of French or German books, can furnish this literature to any one interested in it.

There are various types of electric furnaces, adapted to different kinds of service. For some purposes extremely high temperatures are necessary, and for these the electric furnace is indispensable, since the result desired cannot be obtained in any other kind of furnace. The highest temperatures attainable by combustion of solid or gaseous fuel, with pre-heated air, approximate 1,500 to 2,000 deg. Cent. (2,700 to 3,600 deg. Fahr.), and it takes a large consumption of fuel and there is a large waste of heat in attaining such temperatures on an industrial scale. The electric furnace, however, is limited in temperature only by the resistance of the material with which the furnace is lined, and the volatilizing temperature of the carbon electrodes used for carrying current into the furnace. The latter temperature approximates 3,700 deg. Cent. (6,700 deg. Fahr.), which is above the melting point of any ordinary material with which a furnace can be lined, excepting carbon. The ordinary refractory materials used in furnaces burning fuel melt at a temperature between 1,500 and 2,000 deg. Cent. (2,700 to 3,600 deg. Fahr.), and carbon is practically the only material which will stand the higher temperatures attainable in an electrical furnace.

It must not be supposed, however, that the electric furnace necessarily must be run only for the attainment of very high temperatures. Some of the most successful electric furnaces, operated where electric power is cheap and fuel is relatively dear, are operated at temperatures no higher than are obtained in ordinary non-electrical furnaces. The electric current is in this respect somewhat like a race-horse which is capable of running at high speed (high temperature) and yet which can be loaded down so as to work at low speed upon heavy loads (low temperatures). In fact, the ordinary electric oven or the toaster used in our houses is on the principle of an electric furnace, but operates at very moderate temperatures.

Arc Furnaces.

Such furnaces are simply enormous electric furnaces, on the same principle as an electric arc used for lighting, excepting that they are surrounded as completely as possible by the material to be heated, and the heat radiated from the arc is utilized for purposes of fusion, chemical reaction, etc. The maximum temperature close to the arc may be as high as 3,700 deg. Cent. (6,700 deg. Fahr.), but the material surrounding the arc is not by any means necessarily heated to this extreme temperature. The charge receives the radiated heat and is carried to as high a temperature as the amount of heat radiated from the arc can heat the substance. If the substance is small in amount and brought nearly in contact with the arc, it may be heated nearly to the very high temperature named; but if the arc is surrounded by a large mass of the substance under treatment, then the material is heated only to the average temperature to which the electric energy converted into heat in the arc is capable of heating this large mass of material; this temperature may be almost anything, down to ordinary low furnace temperatures.

Illustrations of the use of the arc furnace are the Stassano furnace for melting steel, the DeLaval furnace for smelting zinc ores, the calcium carbide furnace, the ferro-silicon furnace, the furnace for fixing atmospheric nitrogen and thus producing nitric acid from the air. These furnaces work with the material heated from 1,500 deg. Cent. (2,700 deg. Fahr.) to 3,000 deg. Cent. (5,400 deg. Fahr.). Their chemical possibilities depend upon either one of two things, first, that materials for reactions are produced in them not producible in furnaces run by fuel (nitric acid, calcium carbide, ferro-silicon), or, second, that they are cheaper to apply than ordinary furnaces (smelting zinc ores and melting steel, in Sweden or Norway).

I have mentioned some of the more common applications of these enormous arc furnaces, but many others are under experiment and will undoubtedly be developed in the future. Their real and proper field is for carrying on operations at high temperatures not obtainable by other and non-electric means.

Resistance Furnaces.

This type of furnace passes the electric current continuously through some material offering resistance, and generates therein the high temperature required. There is no arc or break in the electric circuit; these furnaces are run simply on the hot-wire principle—a conductor is heated by the passage of an electric current, and sufficient current is sent through a particularly designed resistor to generate the heat and temperature necessary for running the furnace.

This is a large, useful and important class of furnaces, which is entering into many industrial operations. They are preferably operated by alternating current, although this must be of low voltage for most resistance furnaces. Examples are numerous; one of the simplest is the furnace of Mr. Acheson in which several tons of ordinary anthracite coal is converted into graphite by the passage of the electric current through the coal itself, thus heating it (properly shielded from the entrance of air) to a temperature of at least 3,000 deg. Cent. (5,400 deg. Fahr.) during a period of about twenty-four hours and converting it into soft unctuous graphite of many times the value of the material put in the furnace. Another example is the mixing of ordinary silica sand with coke and saw dust, and passing an electric current through a heap of the material piled between electrode terminals twenty to thirty feet apart. With a voltage of 100 to 200, and a current of over 1,000 horse-power, the electric current generates within the mass a temperature sufficient to form from these ingredients the well-known material "Carborundum," which is formed at a working temperature of 2,240 deg. Cent. (4,000 deg. Fahr.). Large industries have been founded upon the invention and use of these electric furnaces, so simple in principle and yet which require the highest inventive skill and industrial pertinacity to devise and operate successfully.

Induction Furnaces.

These are really a special kind of resistance furnace, the material or resistor being heated by the passage of an electric current, but not by the current originally sent to the furnace. The furnace itself is an electric transformer, receiving high-voltage alternating electric current, and transforming it to low-voltage current of great quantity, and the induced or secondary current of the transformer is the heating current which passes through the resistor and doing the useful furnace work.

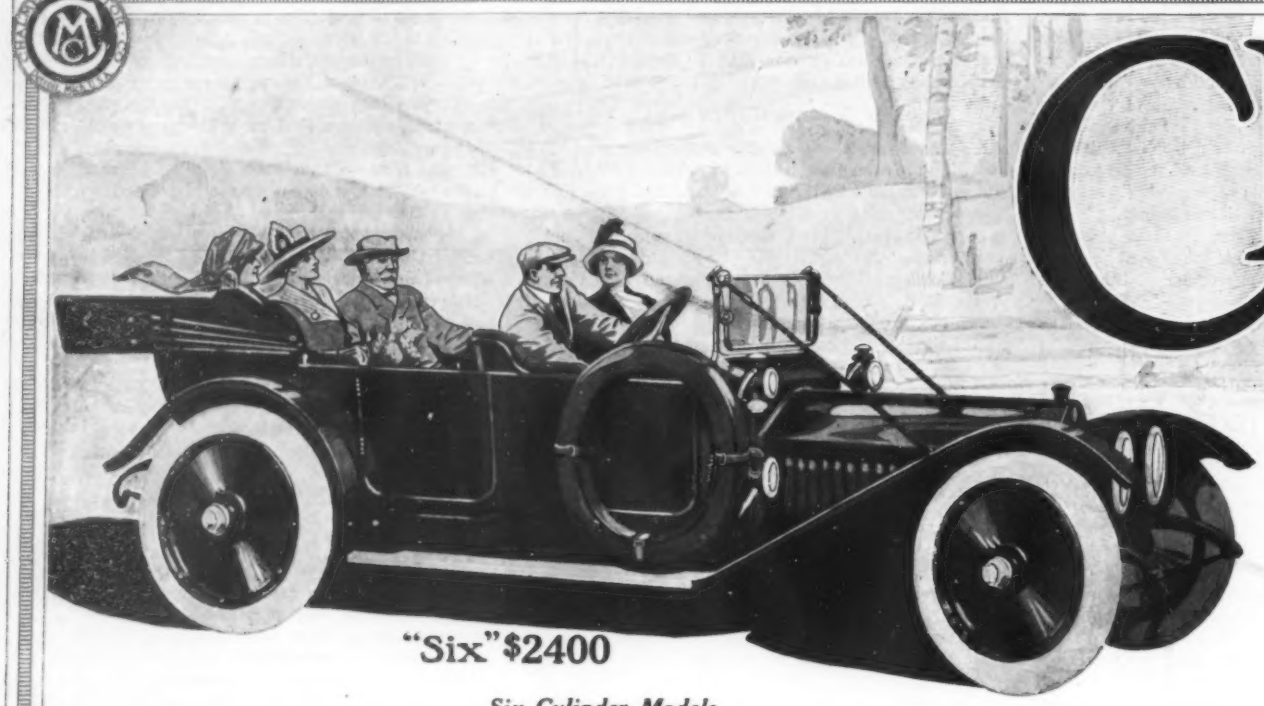
A reference to the ordinary transformer with which almost every one is familiar may make the matter clearer. Electric current is sent along many of our thoroughfares at 2,000 volts tension, a current which would be very dangerous if it entered our houses, but which is transformed at convenient stations into low-tension current for safe use. The apparatus accomplishing this is called a transformer, the original current passing through the primary winding of the transformer, while the useful current is taken away from the secondary winding. The induction electric furnace operates on exactly the same principle; it has a primary winding receiving the high tension electric current but its secondary winding is the material itself which is to be heated, arranged in a closed circuit, so that all the energy of the secondary electric current is utilized as it is generated in the furnace itself.

Electric Furnaces.

These last are in reality not primarily furnaces; they are furnaces only *incidentally*. If we electrolytically decompose a liquid by passing a direct current through it, the operation is electrolysis. Such operations are familiar to every one: Gold, silver and nickel-plating baths; electrolytic refining of copper, silver, gold, lead; electrotyping; electro-engraving; reproducing coins, medals, etc. Others less well known are the obtaining of metallic sodium from fused caustic soda, of calcium from melted calcium chloride, of aluminium from a fused bath containing fluoride of aluminium and sodium with alumina (aluminium oxide) dissolved in it. Now, when these fused baths are kept melted by the heating effect of the passage of the electrolyzing current itself, the apparatus is called an electrolytic furnace. It is, therefore, a pot primarily run for electrolysis, whose necessary temperature may be maintained by externally-applied heat (as by building a fire around the pot); but when this necessary temperature is maintained by the internally-generated electric heat, the result is not simply an electrolytic cell, but an electrolytic furnace. The amount of heat generated by the current depends on the strength of current and the distance of the electrodes apart; it can be regulated with exactness to that required to supply radiation losses and keep the contents at the proper working temperature. Sir Humphry Davy was the first to experimentally use this principle, Mr. Charles M. Bradley of New York patented the electrolytic furnace, and Mr. Charles M. Hall was the first to practically run electrolytic furnaces in the production of aluminium.

These types of furnaces, with others possibly still to be invented, are revolutionizing many branches of industrial chemistry and metallurgy, and are founding or establishing many new ones. They deserve serious and intelligent attention.

The German Observatory in Spitzbergen, which was established by Prof. Hergesell partly with a view to determining the meteorological conditions that will be encountered by the projected expedition of Count Zeppelin *via* airship to the North Pole, has completed a full year's work with such fruitful results that it has been decided to keep the institution in operation another year. The two observers, Drs. Rempp and Wagner, have been relieved by Dr. Kurt Wegener, lately in charge of the Samoa Observatory, and Dr. Robitzsch. During last winter a series of aerological observations was carried out with kites, pilot balloons, captive balloons, and sounding balloons, yielding a unique body of information concerning the winter conditions in the upper air of the Arctic regions. Valuable contributions to the climatology of Spitzbergen were made through the maintenance of three meteorological stations at different altitudes; the highest on Mount Nordenskjöld (3,360 feet). Unbroken series of magnetic and seismological observations were also made.



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"Six" 2,4 or ...senger
"Six" 7 Pass...
"Thirty-Six"
"30"

Six Cylinder Models

Touring Car, 5-passenger, $2400 — *Torpedo, 4-passenger, $2400* — *Limousine, 7-passenger, $3700*
Touring Car, 7-passenger, $2600 — *Roadster, 2-passenger, $2400* — *Coupé, 4-passenger, . . $2700*
Prices include full equipment.

WE announce for 1913 big improvements in Chalmers cars in *comfort, convenience* and *appearance*. For it is along these lines that we believe the greatest advances in automobile building are to be made.

Few changes have been made in our chasses. The mechanical features of our cars have been right from the beginning. Satisfactory service in the hands of 27,000 owners proves this.

Here, then, are the principal additions and improvements on Chalmers 1913 cars:

Easier Riding Qualities

Luxurious comfort is built into every detail of Chalmers cars. The Turkish cushions, 11 inches thick, are soft as a down pillow. They are the highest grade automobile cushions made.

The upholstery is of the luxurious overstuffed type. All seats are wide, filled with high grade hair and covered with heavy, soft, pebble-grained leather. A Chalmers car gives you the same restful comfort as a big armchair.

The long wheel base minimizes road shocks. Big wheels and tires, and long elastic springs make all roads smooth. You can ride all day in a Chalmers without fatigue.

More Conveniences for Operator

Electric Lighting, the last touch of luxury, is regular equipment for 1913 on the "Thirty-Six" and the "Six." The Gray & Davis system which we use is featured on some of the highest priced cars; we believe it is the best lighting system built.

Just touch a switch on the dash and you can light at will head, tail, and side lights. No hunting for matches or gas tank key. No getting out of car in dust or mud.

And no more cranking. The Chalmers air pressure starter made 1912 a self-starter year. A season's use has proved this the simplest and most efficient starting device yet designed. You simply press a foot button on the dash and compressed air, released from a tank beneath the car, turns the motor over until it starts on its own power. No danger. No strain on motor.

Continental demountable rims reduce tire trouble to the minimum. Occasional punctures you *may* have are no longer a serious inconvenience. With demountable rims you can change tires in a few minutes.

On the new style Chalmers dash is carried every control and indicator—ignition switch, self-starter button, electric light switch, speedometer, gasoline pressure pump, carburetor adjustment, air gauge, oil sight feed, priming lever, horn bulb—all easy to see and easy to reach.

Added Beauty

Chalmers cars have always been known for their "looks." For 1913, they are even more beautiful than in the past. Flush-sided metal bodies have the graceful bell-shaped back. Dash is of one piece with body. Top of hood and sides of body form one line from radiator to rear seat.

Handsome nickel trimmings will be regular equipment. Leather lining throughout the body and on the dash leaves nothing to scratch or mar. Twenty-one coats of paint and varnish give a finish that cannot be surpassed.

We have perfected Chalmers cars along these lines, we believe, to a greater extent than anyone else, because for the last ten months we have directed all our efforts to making our cars even more *comfortable*, more *convenient* and more *beautiful* than ever before.

The Chalmers "Six," $2400 —A Maximum Car

Quantity production and increased manufacturing facilities make possible this unprecedented price of $2400. Here is a tried and proved six-cylinder car of the finest quality—of Chalmers quality—the first thoroughly high-grade six-cylinder car at a moderate price.

We are proud of this car. No automobile can give you more service, more enjoyment, more satisfaction and pride of ownership than the Chalmers "Six."

In addition to the big features of Comfort, Convenience and Beauty listed above, please note the following:

Power Enough For Anyone

The "Six" motor is a giant of power. Though rated at 54 h. p., it actually develops 60 to 70 h. p. The long stroke motor—4¼" bore x 5¼" stroke—gives it a strong "pull" in sand or mud or on the steepest hill. It can be throttled down to a walking pace on high gear. It picks up instantly. An ideal motor for every requirement—mile-a-minute speed, slow running in city traffic, hill climbing, or dogged ploughing through sand or mud.

18 Notable Features Chalm...

Electric Lights	Increased ... Base
Turkish Cushions	Improved ...
Eleven-inch Upholstery	Chalmers ...
Nickel Trimmings	Long ...
New Flush-sided Bodies	Demount...
Special Silk Mohair Top	Cellular ...

The Utmost Flexibility

Chalmers four-forward speed transmission provides a gear for every requirement. It enables you always to select the gear that will carry your car through any kind of going in the quickest time and with the least strain.

Big wheels and tires.—36" x 4½"—insure easy riding and cut down tire trouble and expense.

Control levers inside the body; pedals for clutch and brake conveniently located; improved accelerator which does not tire the foot; gasoline shut-off valve inside tonneau; exceptional oiling facilities; controls on dash within easy reach—make the "Six" a delightful car to drive.

You Feel Safe in Your Chalmers

The most careful attention has been given by Chalmers engineers to the *factors of safety*. Wheels are unusually sturdy. Axles are built in our own factory of the highest grade steels. Double drop frames are low and of finest heat treated steel. Brakes are extra large in proportion to the weight. Steering gear is of new Chalmers design, with extra heavy drop forged connections none stronger or easier to operate.

Even to the smallest details, the "Six" is a maximum car. Door locks are concealed and equally accessible from inside and outside. Bodies are thoroughly ventilated. All parts of the car are unusually accessible.

The "Thirty-Six," $1950— With Fine New Feature...

Striking improvements and added features make the 1913 "Thirty-Six" more than ever an ideal all-around motor car. It has power in abundance, speed, hill-climbing ability and rugged endurance to meet the utmost demands.

First offered to buyers last year, this car has proved the most popular ever sold at the price. Many refinements and improvements for 1913 give even greater smoothness, quietness, comfort and convenience. For style and good looks it is not surpassed.

Chalmers Mot...omp...

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4 or 5 enger $2400
Pass . . $2600
Six . . $1950
. . . $1600

"Thirty-Six" $1950

Touring Car, 5-passenger, $1950 *Torpedo, 4-passenger, $1950* *Limousine, 7-passenger, $3250*
Touring Car, 7-passenger, $2150 *Roadster, 2-passenger, $1950* *Coupé, 4-passenger, . . $2250*
Prices include full equipment.

res Chalmers Cars for 1913

- ased Wheel Base — Jewelled Magnetic Speedometer
- ovel Tires — 4-Forward Speed Transmission
- men Starter — Big Wheels and Tires
- Starter — Dual Ignition System
- ounting — Carburetor Dash Adjustment
- dar Rain Vision Windshield

The wheel base of the 1913 "Thirty-Six" has been increased to 118 inches, which still further improves its easy riding qualities.

Luxurious Turkish cushions, 11-inch upholstery (the same quality as used on some $5000 cars), tilted seats, all give the greatest possible riding ease. Seats are exceptionally roomy.

Big 36" x 4" tires carry the car smoothly over the roughest roads. The "Thirty-Six" is over-tired, which means less tire expense. Springs are unusually flexible.

Electric Lights on These Cars

Full electric lighting by the Gray & Davis system is furnished on the "Thirty-Six."

Chalmers self-starter, simplified and improved, is furnished on the "Thirty-Six" of course.

A reliable Speedometer, a jewelled, magnetic instrument, is regular equipment.

1913 bodies are greatly improved in design and finish. They have the integral cowled dash, on which are carried all controls. Everything for the handling of the car is within easy reach.

Note the wide doors, smooth straight sides, rounded back, graceful cowled dash, elegant appointments.

The "Thirty-Six" has even more graceful lines than last year. The painting is of the highest quality.

Mechanically Correct

This car will do your work with *power to spare*. The splendid long stroke motor—4¼" x5¼"—has wonderful pulling qualities. Quiet and smooth running at all speeds.

The four-forward speed transmission is one of the distinctive Chalmers features largely responsible for the success of the "Thirty-Six" last year.

Other Chalmers features which made this car such a marked success are retained—such as dual ignition, demountable rims (five), genuine honeycomb radiator, dash adjustment for carburetor, large brakes, frame and steering connections of extra weight and strength.

The 1913 Chalmers "Thirty-Six" offers you every motor luxury—at a medium price.

ompany, Detroit

The New Chalmers "30"— Self-Starting, $1600

With improved motor, Chalmers self-starter, 34"x4" tires, demountable rims, larger brakes, beautiful, new flush-sided body, the 1913 "30" at $1600 is a greater value than ever before.

The price includes also gas lamps and oil lamps, Prest-O-Lite tank, dual ignition, full tool equipment.

For the man who wants a light, fast, low priced, but classy car, the 1913 "30" is the best buy ever offered.

The Chalmers "30" has for five seasons set the standard of values among medium priced cars of this power. It has won more endurance contests, broken more records, been victor in more races than any other car of its size and power. And it has a wonderful record of steady service and satisfaction in the hands of owners everywhere.

Two body types are offered: 5-passenger touring car, $1600; 4-passenger torpedo, $1600.

Fixed Chalmers Policy— Quality Cars at Medium Prices

For 1913 we are adhering to our established policy of always giving the greatest possible value for the price. We have incorporated in our new model, at medium prices, all of the features of higher priced cars and many features not found on other cars of any price.

Chalmers cars have always been known as quality cars. We have never built a "cheap" car, but always high quality cars at medium prices. Big production has enabled us to build such cars at lower cost than could anyone without our volume. We have never tried to secure big volume, however, at the expense of quality or advanced features. Yet each year the extraordinary values in our cars have brought a steady natural increase.

1912 Our Record Year

This past year, 1912, was the best year we ever had. It set a new Chalmers record. Our business showed an increase of 43% over the season of 1911.

We believe that our business will further increase as people appreciate quality at medium price instead of *quality* at *high* prices or mere *quantity* at *low* prices.

We believe the more automobiles come into use, the greater will be the conviction that it doesn't pay to try to save $300 to $500 on the original price, and buy something merely because it is offered at a low price.

Medium priced cars of quality—not only ours, but other good medium priced cars—offer the best values for the money in the long run, and you don't have to run them very long to find it out.

Built in Our Own Shops

Chalmers cars are built by Chalmers workmen in Chalmers shops under Chalmers inspection. We build our motors, transmissions, axles, self-starter, steering gear, and other important parts. We cut our own gears; heat-treat our steels. We even have our own foundry.

No automobile manufacturer builds in his own plant more of the parts of his car than we do. No motor car factory is more completely equipped with new machinery.

Experts tell us no car is built with greater care or more skillful workmanship than the Chalmers; none is subjected to more careful and painstaking inspection.

Backed by Sound Guarantee

Chalmers cars are built and guaranteed by a company of the soundest financial standing. We have a plant covering 30 acres of ground and have $6,000,000 invested in our business. We have made this great investment because we expect to be in this business permanently, and we are convinced that permanent business can only be built up where a manufacturer makes his own parts.

Making our own parts means greater accuracy in our cars and greater value for you. The saving we make by eliminating parts-makers' profits, goes into added quality.

We have prepared a book about the Chalmers factory. It tells, in an unusually interesting way, how Chalmers cars are made. Write for it on the coupon attached.

Order Now For Early Delivery

Now is the time to order so that you can get the use of your car during the best motoring season.

So see these cars at our dealers' showrooms. If you look them over carefully, we are sure the cars will more than bear out our every claim. Again we say, compare them with other cars—point by point—price by price—value by value. Your verdict is sure to be favorable.

And don't forget to send the coupon for the booklet "Story of the Chalmers Car," and our new catalog. You will find this book about the making of an automobile both entertaining and worth while, no matter what car you decide to buy. Just mail the coupon today.

Please send "Story of the Chalmers Car" and complete information regarding the Chalmers 1913 cars.

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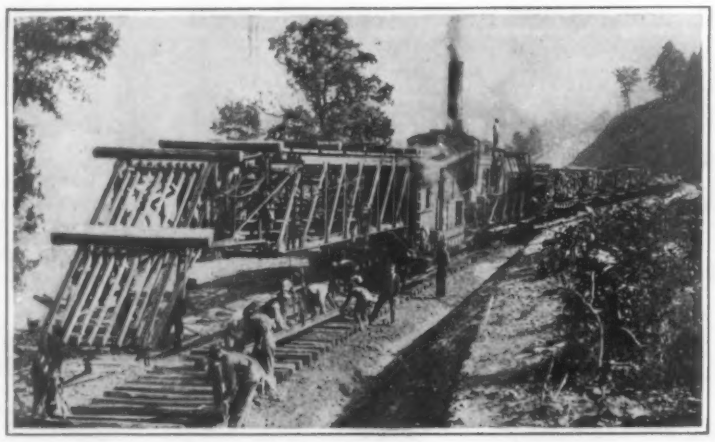
Sci. Am.

Track Laying by Machinery

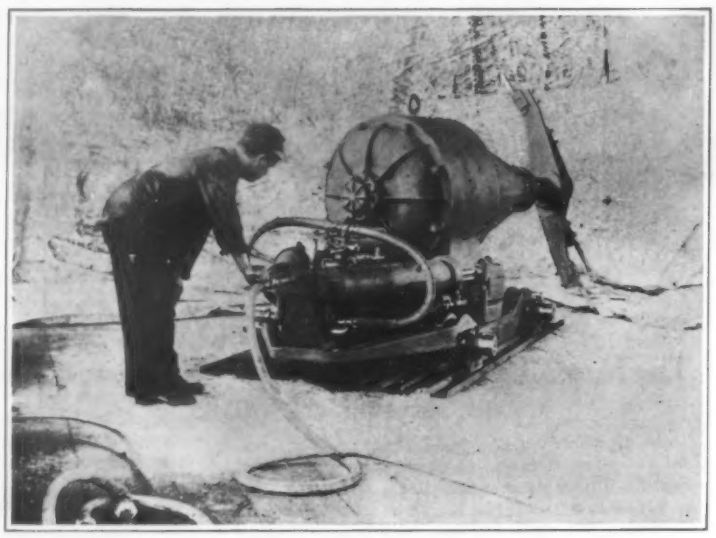
THE modern track laying machine should not be confused with track laying tools, as this machine is not a tool, but a real machine that actually lays tracks as indicated in the accompanying photograph. The machine moves steadily forward over the track it lays at a rate of from twelve to forty feet per minute. At the rear of the track laying machine are cars loaded with ties and rails. The cars which carry the ties are in advance of those carrying the rails. The rails are drawn forward on rollers and are connected temporarily one to the other. As the rails pass under the cars which carry the ties the latter are distributed upon the rails and spaced apart uniformly. The chain of rails thus serves to transport the ties toward the track laying machine. As the rails enter the machine, the ties are picked up by a conveyor and carried overhead. They are distributed on the roadbed at the end of a truss that reaches far in advance of the main body of the track laying machine. The rails in the meantime are carried forward and deposited upon ties previously laid. The truss may be swung to one side or the other in order to allow for passing around curves. The track laying machine is self-propelling. It hauls a train of twenty-five cars of material, more or less depending upon the grade. A train of twelve cars will carry enough material for a mile of track. This machine, with eighteen men, including spikers, can lay and bolt and spike a half a mile of track per day. With a larger force of men two miles of track may be laid in a single day.



Laying track by machine at the rate of two miles per day.

The Wreck of the "Schwaben"

AFTER making a total of 364 flights, in which it covered 28,000 miles and carried 6,045 passengers, the "Schwaben," the first of the huge Zeppelin airships to make regular passenger trips, came to grief on June 28th while anchored outside of the obsolete shed at Dusseldorf in a heavy wind. So much did the airship bob about in the maelstrom that Capt. Duerr decided to go aloft and ride out the gale. He was just about to cast off the mooring cable at the bow when the nose of the ship burst into flame, and he and his crew jumped for their lives. The flame soon ran the entire length of the airship, and she was consumed as she swung at anchor, the fall to the ground breaking her back, as shown in the photograph. The cause of the catching fire of the "Schwaben" in this mysterious manner is thought to be the working of her frame at the bow, where she was tethered. This is believed to have generated frictional electricity sufficient to have ignited the gas. That the cloth covering of the dirigible also had something to do with the generation of this frictional electricity is shown from the fact that the Zeppelin engineers are perfecting a "neutralized" cloth that cannot be electrified. The airship was insured for $162,000. She had made for her owners her entire cost of construction and operating expenses by carrying passengers. The latest Zeppelin, "Hansa," has shown a speed of 49 miles an hour, and the new naval one now building, with 600 horse-power, is expected to travel 60.

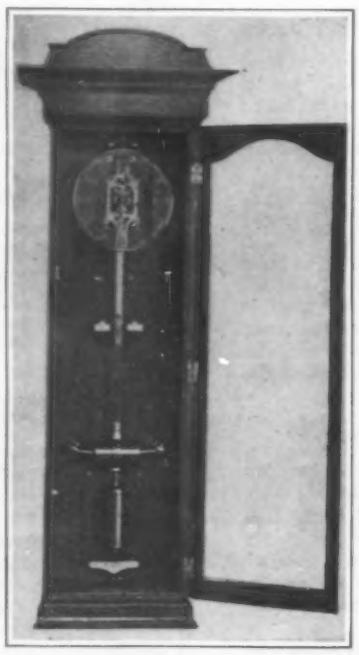


A coal-milling machine.

The tangled wreckage of the Zeppelin dirigible "Schwaben."

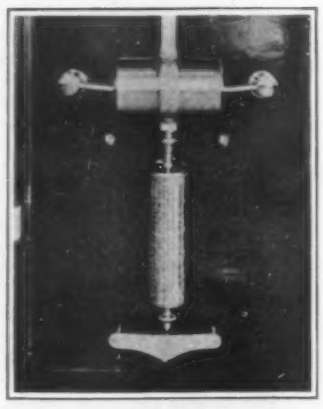
An Earth-driven Clock

IN the ordinary clocks provided with weights and springs, the clock mechanism drives the pendulum. In the clock pictured herewith, however, the operation is reversed for the pendulum drives the clock. The pendulum receives its energy from an electro-magnet supplied with current from an earth battery. Because the earth currents are apt to vary considerably, a special automatic switch mechanism is provided to check the pendulum when it swings too far. Thus, a constant amplitude of oscillation is maintained. The pendulum is provided with a bob, consisting of a coil of insulated copper wire, inclosed in a brass case, underneath which there is a similar bob for making the necessary initial adjustment. The terminal wires from the bob coil are carried to the top of the pendulum where they connect to two springs on which the rod is suspended, and then make connection with the earth battery. A permanent steel magnet is mounted on the clock case, adjacent to the bob coil. The poles of the magnet enter tubular openings at each end of the coil. Hence, when current flows through the magnet, there is either an attraction or a repulsion, according to the direction in which the current passes around the coil.



General view of the clock.

The contact gear.



The exciting coil.

Clock driven by earth currents.

The direction of flow is alternated by a contact gear, which is attached to the pendulum rod. It consists of a small carrier mounted on two wheels that run over a track, secured to the clock case. The wheels run over contacts placed in the battery circuit. The carrier is set in motion by two adjustable contact rods on the pendulum, which push it forward or backward, depending upon the travel of the pendulum at the time. Thus alternate impulses are produced in the coil, which serve to keep the pendulum in motion. To oppose an abnormal swing, the contact pieces are arranged in three parts, so that if the pendulum moves the carriage too far, its wheels make contact with the third members of the contact group and this reverses the current. Recently Prof. Silvanus P. Thompson subjected the clock to a number of tests. In his report he states that if he purposely gave the pendulum a large impulse so that it swung too far, the automatic action of the contact device became evident at once, and after a few swings, the pendulum returned to its normal swing.

A Machine That Enables Coal to Be Pumped

NO industry is more prolific of disaster, both distressful and costly, than coal mining, and no other industry of this country, owing to the crude methods employed, imposes such hardships upon the workman immediately engaged in taking coal from the vein. To alleviate these dangerous conditions J. H. Hoadley and W. H. Knight have developed a system of mining coal by machinery.

Primarily designed to cut the whole seam of coal into a granular state suitable for coking, this coal-milling machine may modify the art not only of mining coal, but of transporting and consuming it. It is well known that granular or powdered coal, with the aid of water, can be pumped through pipes at far less cost than it can be transported by rail. It is also certain that powdered coal, when blown into a furnace with an air blast, burns with much more economy than does lump coal when burned on the grate.

There are, however, 100,000,000 tons of coal coked each year in this country, and it is with especial reference to this kind of coal that the inventors have directed their attention.

The milling machine not only cuts the coal from floor to roof into a finely powdered state, but pumps it, mixed with water of the mine, to a distant coal washer or to coal bins adjacent to the coke ovens. It necessarily does away with the use of explosives, and with the coal dust. The system is a peculiarly safe one to use in gaseous mines on this account.

The machine itself is automatic, advancing by a simple hydraulic feed mechanism which propels it along the floor into the face of the seam, the rotary cutters on the armature shaft of the induction motor cutting the coal very much as a circular saw cuts wood. The motor is given, in addition to its forward movement, a sidewise swinging motion through a limited angle so that the proper width may be cut. Any partings are, of course, comminuted at the same time as the coal, and are separated afterward in the washing process. A fire engine hose leading from some source of water under pressure enables a powerful stream of water to be thrown against the face of the coal while it is being cut, thus eliminating all dust and keeping the tools cold. The water carries off the comminuted product to the nearest sump, whence it is pumped to any desired destination. The machine, owing to its power of advancing directly into the coal, will cut a slope, an entry, a room, or work along the wall.

The Trade-mark as a Business Asset

By W. E. Woodward

[*THE average business man has only the vaguest notion of the value of a trade-mark. He does not realize that it is very often the connecting link between the producer and the ultimate consumer; that it is a symbol of good will, a tangible asset with a determinable money value; that it must be chosen and applied not in a haphazard way but with a due regard for its psychological effect upon the public. Nor does he realize the importance of complying with the statutory requirements which secure to him a property right in a trade-mark comparable with the property right that an inventor acquires by taking out a patent.*

The following is the sixth of a series of articles, written by a man who is at once a trade-mark, an advertising, and a business expert, a man who has a first hand knowledge of the value of trade-marks and of the correct methods of trade-mark exploitation. The series, which will be eventually published in book form, will include discussions, written in business English, of the Federal trade-mark law, analyses of the requirements for registration, the elements of a good trade-mark, and trade-mark protection.—EDITOR.]

Analysis of the Requirements for Registration.—VI.

(*Continued from page 121, August 10th, 1912.*)

The U. S. Sanitary Manufacturing Company was refused registration for a trade-mark consisting of the letters "U. S." with a background of a shield similar to that of the conventional United States shield. The coat of arms for the United States is not registrable as a trade-mark even under the ten years' clause. It has been held that its use in that connection is opposed to public policy. (American Glue Company, ex parte, 120 *Official Gazette*, 324.) The registration of the coat of arms of the State of Maryland was refused registration, application having been made under the ten-years' clause. In another case, registration of a simulation of the shield of the United States, with alternate red and white stripes, was refused registration.

It would seem at first consideration that if the object of using a trade-mark is to indicate the origin of a commodity, the most effective marks would be simply the maker's name—"James Brown" for goods made by James Brown, and "William Jones" for goods made by William Jones. This logic would be indisputable if there was a different family name for every individual. But names are limited in number—there are eleven pages of Smiths in the New York city directory—and every man has a natural and inalienable right to use his own name. But a personal name may be written, or printed, or stamped in such a way that the peculiarities of writing, or printing, or design, may dominate the name and be the most conspicuous feature of the combination.

The trade-mark act provides that "no mark (shall be registered) which consists merely in the name of an individual, firm, corporation, or association, not written, impressed or woven in some particular or distinctive manner, or in association with a portrait of the individual." In this clause the framers of the act have endeavored to put a logical restriction on the injudicious use of personal names as trade-marks and the endless litigation that has always resulted from this practice.

The names of historical personages (not living) may be registered as trade-marks, but the name of a living person cannot be used without his consent. The phrase "Gibson Girl," as a mark for shoes, was refused registration, as the word "Gibson" obviously referred to Charles Dana Gibson, a living artist. In case of the registration of the names of individuals, firms or corporations, the restriction of the law that the name must be shown in some "particular or distinctive manner" has been interpreted to mean a presentation of the name in such a form that the peculiarities of lettering, or writing, or of an accompanying device are so pronounced that they dominate the name and throw it into a position of secondary importance. The meaning of this clause is best shown by means of examples of proper names, registered and used as trade-marks.

Many portraits of living persons are used as trade-marks, notable among them being the face of W. L. Douglas, shoe manufacturer, and the portrait of Thomas A. Edison, used in connection with his facsimile signature, as a trade-mark for Edison phonographs. Among historical characters, the picture and signature of Robert Burns, the poet, are combined in a trade-mark for cigars; the face of Benjamin Franklin is used as a trade-mark for the *Saturday Evening Post*, and will be found printed on the editorial page of each issue; Bismarck is a name for collars; Napoleon is used in connection with a brand of flour, and "Bob" Ingersoll is the trade-mark of a cigar.

It is a definite principle of the common law that fraud vitiates any transaction that it touches. A trade-mark that is deceptive and misleading cannot be protected, no matter if its registration should be accomplished. "Knights of Labor" was refused registration as a trade-mark for whiskey as the evident intent of the mark was to mislead purchasers into a belief that the whiskey was produced by the Knights of Labor, a labor organization. A similar case is exhibited in the attempt to register the name "Masonic" as a mark for cigars. Registration was refused. The name "Malt Myrrh" was refused registration as trade-mark for malt liquors when it was shown that the liquors did not contain myrrh. The name "Old Country Soap," used in connection with soap in such a way as to lead purchasers to believe that the soap was manufactured in Europe, was held by the court in the case of Wrisley v. Iowa Soap Company, to be deceptive, and protection against infringement was refused.

A false representation on a trade-mark to the effect that the article is patented, when it is not, is sufficient to vitiate the trade-mark. A trade-mark registration does not protect when it is used on an article different in character, or composition, or origin, from that for which it was registered. This principle is very important. A manufacturer cannot do as he pleases with his trade-mark without regard to the rights of the public. If the article for which it was registered is changed essentially in composition, or in purpose, the trade-mark ceases to be of value. Trade-marks under the United States law are always specific and associated with a certain definite article, and not with the proprietor's general business. In Great Britain and Canada there are general trade-marks, which the manufacturer may use on any article he makes, no matter to what diverse classes these articles belong.

A trade-mark which is technically a valid mark, will be refused registration if, in the opinion of the Patent Office, its registration would be opposed to public policy. A few examples will show what we mean. The phrase "Ask the Revenue Officer" was rejected as a mark for whiskey. The Patent Office held that this mark, appearing on bottles or barrels, would lead the public to believe that the contents had the endorsement of officers of the government. For similar reason the word "Government" was refused registration as a mark for loose-leaf binders. The name of a living ex-President cannot be registered without his written consent (as in the case of any other living person), and the name of an ex-President not living cannot be registered at all. The use of the name of an ex-President as a trade-mark is not considered consonant with the high dignity of the presidential office. Several applications have been made within the last few years for registration of the names or portraits of ex-Presidents. The signature and portrait of Thomas Jefferson, combined in a trade-mark for cigars, was refused registration. The words "Roosevelt Rose" were rejected on application for registration, the rejection being partly because "Rose" had been registered on a previous application, and partly because Roosevelt is a living person.

A trade-mark cannot be a color, because the number of colors is limited, and it would be manifestly unfair to give the exclusive use of a color to any individual.

The use of the flag or coat of arms of any foreign power is prohibited as a trade-mark. This restriction holds even when the foreign power agrees to the use of its insignia. The Russian Government consented to the use of its coat of arms as a trade-mark in the case of an applicant before the United States Patent Office, but registration was refused. The law is mandatory, and is not affected by agreement.

Any design or picture which has been adopted by a fraternal society as its emblem is not registrable as a trade-mark. For obvious reasons, scandalous or immoral matter is refused registration. A trade-mark cannot be a shape, or a package, or a container. A trade-mark cannot be the article of merchandise itself, for the "mark" must necessarily be different from the thing marked.

Proposed Amendment to the Trade-mark Law.

An amendment to the Act of 1905 is before Congress. This amendment, which will, in all probability, become a law, denies the right of anyone to register as a trade-mark any mark which consists of "any name, distinguishing mark, character, emblem, colors, flag or banner, adopted by any institution, organization, club or society which was incorporated in any State in the United States prior to the date of the adoption and use by the applicant." This proposed addition to the law is the result of an attempt of certain manufacturers to capitalize the prestige of various well-known clubs and other organizations. A case in point was a recent attempt to register the initials "Y. M. C. A." as a trade-mark. Another flagrant case was the adoption of the emblem of the New York Athletic Club—a winged foot—as a trade-mark by a manufacturer of men's clothing. On formal protest by the New York Athletic Club, the registration of this mark was held up.

The Trade-mark Status of Patented Articles.

A patent may be defined as an exclusive monopoly in the manufacture and sale of a new and useful invention granted by law for a term of years to the inventor. As an offset to this monopoly, granted to the inventor as his reward from the public, the inventor's exclusive right ceases at the expiration of the patent, and any one may manufacture and sell the invention.

It would be manifestly unfair to the public if the owner of the patent could, at its expiration, still retain the exclusive right to use the name and trade-mark under which the invention has been sold. If this were permitted, the effect would be a partial continuance of the monopoly. The name and trade-mark belong to the article—not to the individual—and the right to use them goes with the right to manufacture the article.

The Singer Manufacturing Company, when the patents on its sewing machine were about to expire, adopted as a trade-mark the word "Singer" blended with a device. The effect of this action, if the validity of the trade-mark had been sustained, would have been to perpetuate the right to the exclusive use of the word "Singer" as applied to sewing machines. In this event, at the expiration of the patents, any person would have the right to manufacture Singer machines, but only the Singer Manufacturing Company would have had the use of the name "Singer." It was held by the courts that the right to use the name "Singer," as applied to machines of this particular design, became public property when the patents expired. The court said, in the case of Brill v. Singer Manufacturing Company (41 Ohio Stat.):

> "A patentee or his assignee, by incorporating into his trade-mark the distinctive name by which a patented machine has become known to the public during the existence of the patent, cannot, after the expiration of the patent, take away from the public the right of using such name. The trade-mark cannot be made a guise for extending the monopoly, or preventing the name from becoming, with the patent, the property of the public."

The Singer case is typical of cases of this character. In the case of Dover Stamping Company v. Fellows (163 Mass. 191, 194, 196) the court said:

> "When one who has a patented article gives to it and puts upon it a name, and calls it by that name and no other, and it becomes known to the trade and to the public exclusively by the name so given to it by the patentee or person controlling the patent, then certainly it may be said that, as a general rule, the right to the exclusive use of the name ceases with the termination of the exclusive right to make and sell the thing."

(*To be continued.*)

Notes for Inventors

A New Patent Office Publication.—The United States Patent Office has issued a volume of nearly 500 pages, being a supplement to the manual of classification and termed "Definitions of Revised Classes and Subclasses of Subjects of Inventions." The purpose of the publication is to explain what is comprehended within the title of the subclasses established by the Patent Office and it will prove a valuable aid to the practitioners before the Patent Office.

An Anti-skid Improvement.—Rikichy Himeno of New York city, has patented, No. 1,030,238, an anti-skid device which includes two side chains to extend alongside the wheel tire and cross chains connecting the side chains at intervals. One of the side chains is separable at a point intermediate its length to divide it into two sections and means are provided for connecting and disconnecting its intermediate separated ends, the ends of both side chains being provided with means for connecting the same.

Another Peter Cooper Hewitt Lamp.—Peter Cooper Hewitt has secured another patent, No. 1,030,178, for a mercury vapor lamp in which is provided a highly exhausted chamber in the shape of an inverted U, which has a main light giving portion of uniform diameter and is expanded at each end into enlargements which are partly filled with mercury constituting electrodes. A condensing chamber is centrally located along the tubular portion to regulate the vapor pressure within the container.

Legal Notes

Public Use Proceedings.—Public use proceedings are initiated upon the petition of some person or persons believing they are in possession of evidence showing that the invention forming a part of the subject-matter or the entire subject-matter of an application for patent filed by another, was in public use or on sale more than two years prior to the filing of the application for patent. This question of public use is the only material one involved and in a recent case of *ex parte* Wenzelmann and Overholt, Mr. Billings, the first assistant commissioner, has held that a public use proceeding is not instituted to determine when the party filing the petition made the invention or whether he ever made it and that the sole question to be determined is whether the invention was in public use more than two years before the applicant filed his application.

A Copyright Treaty Between the United States and Hungary.—The pirating of a play from the Hungarian and produced with much success in this country is said to be at the bottom of a copyright treaty recently concluded between the United States and Hungary. The treaty gives Americans the right to secure literary, artistic, dramatic, musical and photographic copyrights in Hungary on the same terms accorded to native Hungarians. In return, full copyright privileges are extended by the United States.

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY. You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. *In every case it is necessary to give the number of the inquiry.* Where manufacturers do not respond promptly the inquiry *may* be repeated.

MUNN & CO., INC.

Inquiry No. 9262. Wanted to buy a glass which is a conductor of electricity, and the address of the makers of the same.

Inquiry No. 9263. Wanted name and address of manufacturer of pantaloon stretchers with clamps, which is capable of being folded up.

Inquiry No. 9264. Wanted the name and address of manufacturers of date pitting machines.

Inquiry No. 9265. Wanted the names and addresses of manufacturers of machinery for making picket fences.

Inquiry No. 9266. Wanted to buy machinery for fastening wire cloth to wooden frames with coppered tacks.

Inquiry No. 9267. Wanted addresses of manufacturers of metal specialties in connection with plate or window glass.

Inquiry No. 9272. Wanted names and addresses of engravers and mounters of fine quality maps or plans of large cities. Large order.

Inquiry No. 9273. Wanted to buy a globe for a parlor fountain, working on the Heron system.

Inquiry No. 9274. Wanted the name of a manufacturer of a machine to make cushion covers for fruit crates.

Inquiry No. 9275. Wanted name and address of manufacturer of stock patterns of platen job printing presses.

Inquiry No. 9276. Wanted a household convenience and necessity which can be retailed at a profit at a price of from $1.00 to $2.00.

Inquiry No. 9277. Wanted a machine for packing dry batteries.

Inquiry No. 9278. Wanted a machine for separating crab meat from the shell.

Inquiry No. 9279. Wanted a machine for shredding asbestos board.

Inquiry No. 9280. Wanted names and addresses of manufacturers of machinery for stuffing dolls and teddy bears.

Inquiry No. 9281. Wanted to buy machinery for bleaching walnuts and ivory nuts.

Inquiry No. 9282. Wanted name and address of manufacturer of coin-controlled gasoline-dispensing tanks for automobile use.

Inquiry No. 9283. Wanted name and address of dealers in powdered Cocoa and Kola nuts in bulk.

Some Plastic Agglutinants

THE word "plastic" expresses the quality of bending, yielding, or flowing under pressure. Plasticity is a condition of fluidity, although it may be something more. Many metals are plastic; the flow of glaciers is due to the plasticity or fluidity of the component ice; the earth itself, in fact, flows or moves under pressure. Fibrous substances are not plastic, that is, they do not flow under pressure. Plasticity may be of a permanent character as in the case of asphalts and bitumens, lead and ice, or it may be only temporary as is the case with bodies having setting qualities, as plaster of Paris, caoutchouc and sulphur, phenol and formaldehyde, or clay before and after burning. In many instances the plastic agent is used with a filler of some inert material. That is, our plastic body is not only made to take some desired shape but it has to carry particles of some other material with it. Thus, a concrete block is a mass of gravel and sand held together by the cement; a piece of linoleum is a mass of cork dust held together by a set binder of linseed oil and sulphur or oxygen. The plastic substance must then have also agglutinating qualities, i. e., it must adhere to the particles of whatever materials may be put with it.

This opens up a large subject. If the filler is of dense material like sand, say, the binder will hold such particles by mere surface adhesion. If the filler be porous, the particles become saturated with the binder and may be said to be anchored thereby, like particles of cork in linoleum or cellulose fiber in heavily sized paper. In the first instance, the binder merely fills the voids between the particles of filler. In the second, the filler floats, as it were, in a saturating menstruum. If the first is of a kind that shrinks on setting or drying, it can not pull the particles completely together, and must either put itself under molecular strain or it must leave voids or openings in its mass. In the second instance, if the agglutinant is one that shrinks, the whole mass is merely pulled closer together or reduced in size; that is, the object shrinks on drying or setting.

Binders With Hydraulic Qualities.

Agglutinants or binders are of many kinds and uses. Of one familiar type are those which have setting or hydraulic qualities. The most prominent exponent of this type is Portland cement. Like all cements it has the property of setting, i. e., absorbing water, and by means of this becoming hard and coherent. The water in this instance becomes a part of the mass and helps to form a hydrated silicate or perhaps several, the exact nature of which is still somewhat in dispute.

Another common binder is plaster of Paris. This also possesses the property of hydrating. Its uses in the arts are numerous, the most common being as an ingredient of wall-plaster, where it is combined with various agents for controlling or retarding the rapidity of its setting. Mixed with alum it forms the material known as Keen's cement, from its discoverer—the alum making the plaster harder.

Another binder is magnesium oxychloride. When magnesia is mixed with a solution of magnesium chloride it forms a compound, an oxychloride, which is quite hard and wears well. It is a principal ingredient in many compositions for composite floors—in bathrooms, kitchens and similar locations. It has been proposed as a binder for fuel briquets.

Linseed Oil and Vegetable Binders.

The number of binders of vegetable origin is legion. Probably the one most used is linseed oil. If this oil be given a sufficient supply of oxygen it oxidizes into a resinous body—dries, as painters say. This drying can be accelerated by supplying it with an oxygen-transferring body—a catalyzer; lead oxide is the one generally used. The molecules of this will give off oxygen to the oil and in turn will take others from the surrounding air. Linseed oil is the main binder in linoleum, which consists mainly of ground cork held together by oxidized oil. Various mineral or vegetable fillers are added and, of course, coloring matter. Other oils have the same quality, one, Chinese oil, derived from the nut of the tung tree, in a degree even greater than that of linseed oil. This phenomenon of hardening is also in part the result of a polymerization—perhaps in several stages; that is, the molecules, at first of comparatively simple structure, unite to form molecules of more complex structure.

Gluten, gum arabic, dextrine, are also occasionally used, though their use is mainly that of simple adhesives. They are too brittle and too easily solvent to be very efficient as agglutinants. Starch is another often used. When boiled with alkali it acquires better adhesive qualities. These have no hardening qualities.

Animal Agglutinants.

Glue or gelatine, casein and albumen are the animal agglutinants. These can all be hardened, i. e., rendered insoluble by treatment with various agents. Tannic acid is the oldest and best known for glue. It converts the soluble glue of the hide into an insoluble tannate which can only be broken up by prolonged treatment with alkali. Formaldehyde is another. Chromic acid, or compounds containing it, is another. These adhesives generally form the vehicles of the various sizes for paper, cloth, yarn and kalsomine. It may be stated here that the binders we have been discussing are nearly all to be found used as vehicles for pigments. A paint is more nearly liquid than the so-called plastic compositions hitherto discussed, but it consists essentially of a body of coloring matter—pigment, suspended in and held in place by a suitable menstruum. The menstruum becomes hard through the evaporation of a solvent, and through the resinification of the vehicle. Plastic and coating compositions are essentially the same and are in fact often interchangeable.

Cellulose Fiber in the Arts.

The most universal product of vegetation is cellulose fiber. If we separate fiber from the gums, resins and pectoses with which it is arranged in the structure of the plant we get, of course, pure cellulose, and if this mass of fiber be beaten, matted or felted together into a sheet or layer we get approximately pure paper, like filter paper or blotting paper. Cellulose fiber is insoluble in water, but if the fibers be pressed, crushed, rubbed together in water for a long time, hydration of the cellulose can be carried to such a degree that the filler breaks down and becomes a slimy mass which will dry bone hard. If a sheet of paper be heated in a concentrated solution of zinc chloride it is gradually dissolved. If this solution be squirted through a fine hole into alcohol a firm thread is produced which may be carbonized to make carbon lamp filaments. If the sheet of paper be incompletely gelatinized it becomes, after suitable treatment, vulcanized fiber. If a sheet be passed through sulphuric acid it becomes vegetable parchment. If a solution of cellulose be treated with carbon disulfid, a soluble syrupy compound is formed which separates into its constituents—alkali, carbon disulfid and cellulose. The amorphous cellulose thus obtained is known as viscose. It is used in sizing pulps and generally as a carrier or vehicle for coating paper and fabrics. It is also combined with cork, leather, etc., to form plastic masses. It may also be drawn into fine threads or filaments. They are somewhat used as substitutes for silk but are weaker when wet than other artificially made filaments. They are not especially inflammable.

If a mass of pure fibrous cellulose be treated with a mixture of nitric and sulphuric acids there results a nitration of the cellulose and formation of nitrocellulose. The nitration may be carried to a varying extent, the N_2O_5 (nitric oxide) radical replacing the H in the cellulose, the mass formula of which is given as $C_{24}H_{40}O_{20}$, to any number, from one to twelve. Since N_2O_5 represents a strong oxidizing radical the higher nitrates are very rich in oxygen. They are therefore useful as explosives, gun cotton and smokeless powder containing them. The lower nitrates, while inflammable, are not readily explosive. When dissolved in suitable solvents such as acetone and amyl acetate, they become the basis of pyroxyline compounds. Celluloid is nitro-cellulose mixed with camphor. It is not affected by moisture and it may be transparent if a proper solvent is used. It is thus useful as a varnish, though the objection to it here is that it does not stick readily to wood. It is used in the manufacture of buttons, combs and ornaments of various kinds, in making which it is generally mixed with a heavy charge of filler.

A solution of nitro-cellulose may be spun or squirted in the form of a fine filament, from a suitable orifice into some medium which will dissolve or withdraw the solvent. This produces so-called artificial silk. A similar process is employed for making artificial horsehair and whalebone.

The Celluloid Industries.

Celluloid when deposited from many solvents is transparent. In thin sheets it is as transparent as glass without the slight greenish tinge which most glass, in the opinion of experts, imparts to objects seen through it. The fact that it can be made in bands of indefinite length renders it especially useful for picture films. These films are usually made by allowing a proper solution in a volatile solvent to fall upon a moving band or wheel. As the solvent evaporates, the film acquires coherence enough to let it be lifted off, dried and trimmed. It may be coated then or later with the proper sensitive emulsion. There are said to be three hundred moving picture theaters in New York alone, there are two hundred in Berlin, as many in Paris, and more in London. The demand for this purpose is said daily to amount to almost 600,000 meters—in value over a hundred thousand dollars. These films are inflammable to a high degree however. This has led inventors to attempt to find suitable substitutes. The best of these is probably cellulose acetate—a compound corresponding to cellulose nitrate with a corresponding change of acid. This changed result is attained usually by acetating hydrated cellulose and dissolving the product and treating as with nitro-cellulose. The cost is almost ten per cent higher but the product is not dangerously inflammable. It will, of course, burn like all organic substances, but it is no more inflammable than so much wood.

Chemists in certain German laboratories have been engaged for years in the analysis and synthesis of caoutchouc with a view to its commercial production. If vapors of turpentine be passed through a heated tube and condensed by a spray of hydrochloric acid, or the vapors be condensed and agitated with hydrochloric acid, solid caoutchouc (polyprene) will be formed. Another method recently discussed in this journal starts with starch, which, by fermentation, is partly converted into fusel oil, i. e., the higher alcohols. These, by subsequent treatment, are converted into isoprene, which changes readily into polyprene. This seems easy, and there are other processes which seem just as easy, but natural rubber either from plantation or from forests is still the main source of supply. A limited supply is obtained in the southern part of the United States, and from Mexico, from a desert shrub called the Guayule. All natural rubbers contain a varying percentage of resins and gums other than rubber—and Guayule is no exception. The purest in this respect is that known from its principal place of export as Para rubber. There are more than one hundred and fifty plants from which rubber of one grade or another is derived.

Crude rubber is of little use as such. It is too soft and runny. It is usually compounded with sulphur, which hardens and fixes it. The product, according to the proportion of sulphur used, is known as soft or hard rubber. Rubber is ordinarily adulterated with a large per cent of substitutes and is charged with a variety of fillers.

There are so-called rubber articles made which do not have one per cent of pure new rubber. They have rubber substitutes—oils, particularly corn-oil, and reclaimed rubber, with various other cheaper mineral or vegetable diluents.

It is used rather for its elastic, insulating and waterproofing qualities. It is not pre-eminent as agglutinant merely.

Bituminous and asphaltic binders are mostly used in binding aggregates for

EPICYCLIC TRAINS, which play an important part in toothed gearing, are ably described in Scientific American Supplement 1524. Price 10 cents. For sale by Munn & Co., Inc., and all newsdealers.

street use. The ordinary asphalt street pavement consists of a layer or blanket of asphalt and some fine filler, resting upon a foundation, generally of bituminous or hydraulic concrete or both. The asphalt has no particular strength of its own. It is the roof for the structure below. It must stretch during shrinking by cold, it must shed water, it must not crack, it must not flow when the summer sun beats upon it, and it must give a sufficiently gritty hold to hoof and tire. Asphalt seems well adapted for these purposes. Asphalt is also the basis of many paints, varnishes and japans.

Substitutes for Celluloid.

If a mixture of carbolic acid and formaldehyde be heated an oily viscous liquid soluble in alcohol and acetone will be produced. If this be heated under pressure at a temperature above the boiling point of water, a hard, brittle, insoluble, infusible and otherwise refractory substance will be produced. If the treatment is stopped before reaction is complete, the result of the reaction may be powdered and placed in molds and again heated. This is the substance known as bakelite. Other similar products are on the market. This product lacks the elasticity of celluloid, but it is harder and is incombustible as well as infusible. It may be combined with fillers of various kinds, and for many purposes is obviously better than celluloid.

In cork-soled shoes the bottom of the shoe is filled in with a mixture of ground cork and gutta percha or similar gum and a suitable solvent. This is difficult to work, is expensive, and the solvent makes it inflammable. Wax tailings, a residuum of petroleum distillation modified by various agents, has been successfully used instead. It is said to obviate many of the objections to which the gutta percha or similar binding agent is liable.

The foregoing indicates to some extent some of the most used plastic agglutinants. It would be easy to extend the list. The fillers being for the most part neutral, no discussion of them has been attempted. The same binder may be used for making artificial stone for carrying a wall pigment, for laying the dust on a highway, or for making a fuel briquet.

Recent Research on Lubrication for Gasoline Engines

By Theo. M. R. von Keler

THE lubrication of gasoline engines presents a problem materially different from that which confronts us in ordinary steam engine practice. This is immediately evident when we consider that the temperature in the cylinder of a steam engine may at most reach about 500 deg. Fahr., while in an internal combustion engine it rises as high as 2,640 deg. Fahr. Added to this is the fact that the piston speed in a gasoline engine is considerably greater than in a steam engine. Just what happens to the lubricating oil in the operation of a gasoline engine is not precisely known, but there can be no question that a considerable portion of it burns and is discharged in the exhaust. How much of the oil is destroyed, and how much remains to do its duty as a lubricator, depends on the composition of the lubricant, and the cooling arrangement of the motor.

There is no doubt that the destruction of the oil by combustion cannot be averted; a certain quantity of the oil *must* burn, and *must* find its way in this burned state into the exhaust pipe. If this combustion can be made complete, in so far as the burnt part of the oil is concerned, it follows that there will be less residue and less "smoke." A very thick oil, composed of fractions with a high boiling point, naturally will be only partially burned, which would explain the almost universal demand that cylinder oil be medium thick and possess a comparatively low boiling point—just the opposite from what the average driver or owner of a car would imagine would be necessary. The part of the oil which burns, must burn completely and should not leave a carbon deposit in the cylinders. The more carbon there is in the oil, the more oxygen is necessary to complete combustion. Oxygen, however, in a gasoline motor is a precious substance and practically the entire supply drawn into the cylinder on the suction stroke is needed for the combustion of the gasoline itself. The small quantity not thus employed is sufficient for complete combustion of the oil only when the latter does not contain too much carbon.

A series of tests has just been completed at the Royal Experiment Station for Testing Materials at Berlin, Germany, which disclosed some unexpected and highly valuable properties of oil of different chemical composition. The oils examined were separated into two portions by extraction with acetone, which dissolves the heavier constituents of the oil. It was found that "treated" oils, that is to say those from which the heavier portion had been extracted with acetone, gave an exhaust free from irritating odor, while the untreated oil, under similar circumstances, gave rise to pungent smoke, highly irritating to the nose and eyes. It is thus conclusively shown that the offensive products in the exhaust are due to the heavier constituents of the oil.

These tests show also that the various means taken or proposed which are to do away with the nuisance of smoking automobiles do not attack the problem from the correct point. It is not so much a question of absorbing or deodorizing the exhaust gases, as of a proper selection of the oil best suited for the particular motor in which it is to be used. And this selection should not be made by some sort of "rule of thumb" method, but by a careful analysis based on the acetone method. Once decided upon as the best, the oil selected can undoubtedly be obtained from the manufacturers. It would even be possible to divide the oils into specially light ones for automobile use, and heavy ones for steam engines—or to treat them with acetone before marketing them.

Aside from the treatment of lubricating oils with acetone, the science of chemistry knows of no method of analysis at present, which permits of a correct valuation of lubricating oil for combustion motors. Research is going on in practically every large laboratory, and especially in the great automobile factories and oil refineries, but so far no satisfactory method has been found, by which the quality of an oil for automobile use can be ascertained in the laboratory. It is, however, expected that further tests along the line of acetone treatment will evolve a fairly easy, and yet trusty, method of judging the suitability of the various kinds of lubricating oil for automobile use.

[The foregoing is an abstract of a paper of a more technical character, which is published at length in the current number of the SCIENTIFIC AMERICAN SUPPLEMENT.—EDITOR.]

Temperance Beer

IN prohibition States or localities a non-alcoholic malt beverage has been put on the market. This so-called temperance beer must contain less than ½ per cent of alcohol by volume, or it will be subject to the United States internal revenue tax. (See Treasury Decision, No. 1,360, May 19th, 1908.) The aim has been to manufacture a temperance beer containing all the ingredients of normal beer except the alcohol, and which shall resemble it in color, flavor and taste as nearly as possible. There are several methods of making temperance beer. Alcohol is removed from normal beer by methods of careful distillation at low temperature. Hot air or carbonic acid gas is blown through the beer to distill off the alcohol. In this connection the sensitiveness of the albuminoids above referred to should be remembered. After cooling, the non-alcoholic beer is recarbonated with carbonic acid gas. Another method is to conduct the

manufacture in such a manner as to keep the alcohol below ½ per cent. This may be done by stopping the fermentation, sterilizing and recarbonating. Still another method is by mixing normal beer, beer wort and water in proper proportion and carbonating. It is difficult to make a temperance beer that will taste like normal beer; and its keeping qualities are poor. Moreover, the manufacture of good temperance beer is more expensive than that of normal beer, because of the additional manipulations required. It has occurred, therefore, that retailers have sold normal beer for temperance beer and got themselves into trouble by doing so. Probably this is the only instance where a dealer was legally prosecuted for selling the genuine article for the alleged substitute, and this in face of the fact that the consumers made no complaints, but were perfectly satisfied.

The Road Congress

SCIENTIFIC management as applied to the nation-wide problem of building and supervising public roads is to be the keynote of the American Road Congress, to be held on the Million Dollar Pier in Atlantic City, September 30th to October 5th.

The movement for better roads has taken root in every State in the Union. In every community there are men laboring for better roads. The trouble with the movement has been its lack of definite plans and methods for handling the immense problem. The plans and methods are provided at the Atlantic City Congress.

It is not merely to create enthusiasm for an improved system of public roads that the congress is to be held. The enthusiasm is already at hand. The purpose of the congress, which marks the consolidation of the convention interests of the American Association for Highway Improvement, the American Automobile Association and the National Association of Machinery and Material Manufacturers, is to deal with every phase of the road subject in an orderly and scientific manner.

The people of the United States are now spending, for instance, more than $150,000,000 a year on their roads. It is known that they are not getting a full dollar's worth of good road for every dollar expended. In other words, many millions of dollars expended for roads are actually wasted every year because of unscientific methods. Some communities do not build the right kind of roads. Some build roads designed for light traffic and expect them to withstand heavy traffic, and some build expensive roads where inexpensive ones would give better satisfaction. Much of the trouble is due to the fact that there is an absence of scientific supervision of construction and maintenance. There are more than 100,000 officials of more or less importance engaged in the work of supervising the roads of the country, and many of these officials are engaged for political reasons, and not for their ability or competence.

At the American Road Congress civil service will be thoroughly considered in its application to road management. Gen. John C. Black, chairman of the United States Civil Service Commission, will make one of the addresses on this subject. He will explain the importance of putting the civil service, or merit test, to every man having anything to do with the supervision of the roads.

Every other phase of the road subject will be handled in the same scientific manner. The most eminent bankers will discuss methods for safeguarding a proper accounting of taxes and assuring business methods in obtaining loans or making bond issues to build good roads. There is to be a legislative section which will endeavor to point the way to needed reforms in road legislation. The president of the American Bar Association is lending his assistance in preparing the programme for this particular section of the congress.

In conjunction with the congress, there will be a conference of educators with a view to having highway engineering introduced in colleges on a scale that will meet modern requirements. Engineers experienced in road building are not plentiful, and if the colleges could be induced to introduce the right kind of courses, one of the greatest needs of the road movement would be supplied.

It is believed by President Taft, who is the honorary president of the American Road Congress, that better roads mean greater happiness not merely to persons living in the country districts, but to every human being in the country. Better roads mean that the farmer can haul his products at all seasons of the year, doing away with the railroad waste of pulling empty cars back and forth at certain seasons of the year, lowering the general cost of transportation, and finally resulting in a cut in the cost of living to the consumer. President Taft, who is to make an address at the opening of the congress, will point out that the improvement of public roads is the best investment that the American people can make. Of equal interest will be the address to be made by Governor Wilson of New Jersey.

The American Road Congress will be notable in that it will mark the evolution of the road movement from the theoretical to the practical stage. Each phase of the big subject will be handled by the foremost men in that particular line of endeavor. It is felt that scientific management is as applicable to a great subject of this kind as it is to the business of a great corporation. Logan Waller Page, director of the Office of Public Roads, and active president of the congress, believes that the gathering in Atlantic City will put the road movement on such a basis that the time will not be long distant when twenty per cent of the public highways will have been improved. Mr. Page estimates that the improvement of twenty per cent of the roads will bring this nation's road system to a high point of efficiency, almost equal to that of France.

A Substitute for Wood

THE steadily increasing price of timber in Europe has caused interest to be centered in a French invention for preparing a substitute for this article. The process is very simple and inexpensive, the whole process of manufacture being carried out by a single machine. The inventor, Monsieur Carré, associated with the champagne industry, embarked upon this task with a view to preparing an efficient and cheap substitute for packing the bottles of wine, as well as the cases which at present are made of wood, and the cost of which is persistently rising. The first experiments were made about five years ago, and recently some excellent specimens of the substitute have been produced.

The material used in this process is straw. The waste is first split longitudinally by a special cutting device to destroy the resiliency in the stalk. The ripped material is then placed in the machine together with certain ingredients, being laid upon a traveling plate. The latter is kept at a certain uniform temperature by means of steam, so as to cook the straw and the substances associated therewith. When this stage has been carried to the requisite degree intense pressure is applied the results of which are to knit or compress the fibers of straw very closely and tightly together, to form a homogeneous mass. A pressure of between two and three tons per square inch is required in order to produce the best results, and the fabric issues from the machine in continuous lengths of the required thickness and width to be sawn as desired.

In general appearance the material resembles whitewood, the compressed straw

imparting a straight grain-like effect. It works fairly easily, and when sawn leaves a clean cut. Its strength is comparable with the ordinary whitewood, and it can be applied to all purposes for which the latter is fitted. In the preparation of the greater thicknesses such as for joists or posts the better practice is to build up the baulk with layers about a quarter of an inch in thickness laid transversely. Tests with the material have shown that when the cooking and pressing operations have been carried out accurately, the fabric will not disintegrate, and responds readily to the application of tools, though being somewhat denser than whitewood it is harder to work across the grain. It does not split readily when nailed, and should, therefore, prove highly serviceable for making packing cases.

One highly useful application of the invention has been found. This is the production of cordwood for burning purposes. Efforts are being made to introduce it into the Canadian West on the wheatfields of which the straw at present is a waste product, while wood and other fuel is expensive. By means of this machine rough wood suited to burning purposes could be prepared very cheaply. The artificial wood burns with a bright long flame, is practically free from smoke, and gives intense heat, so that it is well suited to steam raising purposes.

The inventor has also devised a means of manufacturing matches from this substitute. This was not an easy matter as the ingredients associated with the raw straw had to be of such a character that they emitted no smell, smoke, and yet burned with a steady flame, as well as igniting readily. Success has been achieved in this connection and an ingenious machine has been devised. In this case the molding plates, both upper and lower, have been corrugated to form round grooves about a millimeter less in diameter than the square section Swedish matches. The plate is made in segments, each of which corresponds to the length of the match, these segments being hinged together so as to travel round the cylinder in the compressing machine, and are ejected in long rows ready for receiving the heads. If desired, however, the matches can be produced in blocks joined together at the lower end similar to the wooden matches that are found in the West, and being torn singly from the block as required.

The matches produced in this manner are similar to the ordinary wooden type, burn readily, while the head and consumed part do not drop off. The cost of manufacturing by this method is less than that of fashioning them from wood, though they are equal to the latter article in every other respect. In the latest experiments the inventor has succeeded in producing an excellent substitute for the wax match, dispensing with the cotton fiber foundation of the latter article.

Another application of the same idea has been the manufacture of a corrugated packing material to take the place of the corrugated strawboard which is used so extensively for wrapping purposes. This product is far stronger than the strawboard article, possesses equal resiliency, and rolls closer when required, so that it constitutes an excellent medium for bottle packing. It is neater and cleaner than the straw packing generally employed for wrapping wines, and after fulfilling this purpose can be subjected to other packing uses.

A Simple and Efficient Canoe Gum

CONSIDERABLE need is often experienced by canoeists and boatmen generally in the lack of a good canoe gum to stop leaks or breaks which may occur in the calking of the boat. When canoeing in the northern waters of Canada or on the lakes in the Adirondacks and the Rockies, it is often inconvenient or impossible to obtain a ready-made gum which will answer this purpose.

A good canoe gum must answer several demands; first, it must be sufficiently pliable so as not to break and powder when in the cold water and under strain; second, it must not melt and run in the sun when the canoe is beached for a short time; third, it must not dissolve or soften when in the water; and last, it must set hard in a few moments if it is to meet the requirements of an emergency. It goes without saying that the raw material must be easily accessible, and the price as low as possible.

All these demands are adequately met by a gum compounded of rosin and vaseline, and the gum can be made in any watertight dish which may be heated over an open fire. One part of vaseline and four parts of rosin, by weight, heated until dissolved in each other will give a gum which, at summer temperature, is soft and easily dented. This is the consistency required for a gum to prevent crumbling in cold waters, such as Lake Superior.

A material compounded of 10 per cent vaseline and 90 per cent rosin is quite brittle when cold. However, in warmer waters farther south, this gum is sufficiently pliable and does not soften or melt readily in the sun.

Addition of rosin makes the gum harder and more brittle, adding more vaseline makes it softer and tougher, so that any consistency may be had from the hardness of rosin to the softness of vaseline.

The above ingredients compounded in the proportions of 10 to 20 per cent of vaseline and 90 to 80 per cent of rosin will answer all the requirements of a first-class canoe gum. It may be carried in a tin or wrapped in paper, and it melts easily over the flame of a match and sticks like glue to warmed surfaces. Any coloring matter may be stirred into the hot liquid gum; for example, Chinese blue gives a bluish green color, red lead gives a brilliant red, and chrome green yields a brilliant green. The best proportions are one part of mineral pigment to one part of gum. The addition of pigments makes the gum very hard.

The Current Supplement

THIS week's copy of the SUPPLEMENT forms a companion issue to the present Chemistry Number of the SCIENTIFIC AMERICAN. Mr. August Neumark, who, by this time, must be known to our readers from several very good articles which he has contributed, gives us the first instalment of an article on Nitrous Oxide and Its Applications, which will run through two issues.—An article by Dr. Raschig on Soluble Gunpowder touches on an important new development.—Mr. C. C. Hutchins describes the laboratory preparation of quartz fibers.—Welding by electricity is becoming more and more important. Our front page illustration forms part of an article on the subject. —Prof. Gockel writes on the Correlation Between Sun Spots and the Weather.—Mr. Carroll Curtis contributes an excellent article on the East Coast Fishing Banks and the Preservation of Our Fish Supply.—One of the most important articles in this issue is from the pen of Mr. von Keler on Lubrication Problems in Gasoline Engines.—Another important subject dealt with is the Manufacture of Ethyl Alcohol from Wood Waste. —Prof. Bone recently delivered a lecture before the Chemical Society at Leeds on his "Surface Combustion Furnaces," which seem to be destined to work a revolution in industrial heating operations. An illustrated abstract of this lecture is published in this issue.—Mr. Johnson describes an ingenious machine for testing iron and steel for their magnetic properties and recording the results graphically. —Using X rays to fit shoes on one's feet may seem at first sight a trivial application, but when it comes to supplying an army with foot-gear, the matter assumes grave importance. An illustrated article tells of a new departure in this direction.

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

INNERSOLE.—F. L. CORSON, 87 Winter St., Rochester, N. H. The innersole is constructed of unusually thin leather, and is reinforced by a ribbed canvas member sewed to the innersole at each side of the rib, so that when the welt and upper are sewed to the canvas member rib the innersole will be reinforced by the canvas and the strain will be distributed on the innersole at each side of the rib.

Pertaining to Aviation.

AERIAL PROPELLER.—HARRY H. ELLIOTT, Lawrence, Kan. The principal feature here is the propeller's variable pitch alterable at will by operating the lever, wheel or other suitable device, and the blades can be set or adjusted so as to give a thrust or pull or neither, when they are rotated. If the propeller is used on a monoplane and mounted in front to give a pull, its reverse position or thrust will act as a brake in case a sudden stop is necessary or desired. For starting or for excess speed or wherever a maximum thrust is desired, it is instantly obtainable and can be maintained. The neutral position is equivalent to a free engine and makes the aviator independent of personal aid when starting. Construction is exceedingly simple, and only a few minutes are required to "take down" the propeller for packing, which can be done in half the space needed for the ordinary wooden propeller. All parts are interchangeable, and an accident to one part, a blade, for example, can be replaced without obtaining a whole new propeller.

MULTIPLEX POWER FLYING MACHINE.—C. V. JOHNSON, Box 1396, Goldfield, Nev. An object here is to obviate the necessity of any great skill of the aviator in case a motive means should give out, by providing a plurality of motors adapted to drive one or more propellers, so that if one is disabled, the other or others will automatically take up the work, keeping up the aeroplane's speed and thus removing any chance of disastrous results on this account.

Electrical Devices.

OVERHEAD TROLLEY.—R. A. PEGLAR, 236 Pope Ave., Toronto, Canada. In this case the trolley rope is wound on a spring-retracted drum which is automatically released when the trolley wheel is displaced from the wire, and whereby the rope is taken up, or wound on the drum, and thus the trolley wheel is drawn down below the wire into position to be easily and quickly reapplied thereto.

ELECTROMAGNETIC DEVICE.—B. SOLDATENCOW, 37 Rue La Pérouse, Paris, France. This invention relates to an electro-magnetic device having a variable action, and it is intended to enable different and distinct effects to be obtained by the action of a single solenoid and a single electric circuit. It can be applied to actuation of apparatus of all kinds, or to the production of electrical, electro-magnetic, or mechanical effects.

PRINTING TELEGRAPH.—B. SOLDATENCOW, 37 Rue La Pérouse, Paris, France. This invention comprises an electro-magnetic device having two distinct actions and provided with a single solenoid by which means it is possible to obtain different and distinct effects. It is thereby possible to reduce the consumption of current, as well as size and cost of apparatus.

ELECTROPLATING APPARATUS.—J. W. DOW, 564 Park Ave., W., Mansfield, Ohio. Mr. Dow's invention relates generally to electroplating apparatus and more particularly it is directed to a new and improved construction adapted for use in depositing metals upon bodies, the construction being especially adapted for use in electroplating small bodies.

Of Interest to Farmers.

SELF PITCHER.—O. D. HUTTO, Russell Springs, Kan. This invention relates to an agricultural machine for taking or gathering grain from stacks and conveying it to a threshing machine or the like. The object of the inventor is to provide a simple machine requiring but little attention for adjustment and operation.

Of General Interest.

DEVICE FOR DEVELOPING PHOTOGRAPHIC FILMS.—DR. W. R. INGHRAM, 735 So. 6th Ave., Tucson, Ariz. An object of the invention is to provide a device having a retainer for each film, the retainers being hinged together and so formed that they may be rolled up in compact form, thereby occupying little space and necessitating a minimum quantity of developer.

PIANO SOUNDING BOARD.—F. B. LONG, 724 So. Broadway, Los Angeles, Cal. The invention provides a sounding board for pianos and similar stringed musical instruments arranged to permit of maintaining the original crown and the desired firmness of the structure to insure the production of a well-sustained tone when the piano is played.

CLOTHES LINE SUPPORT.—E. ESCHELBACHER, 287 Edgecomb Ave., New York, N. Y. This invention provides a support on which laundry may be hung out to dry from the window, the parts being managed from within the room; provides means for forming a passageway through the support; provides within the room from which the windows opens to move the laundry to the outer end of the rack; and provides means for forming a central passage through the rack.

ALUMINIUM SOLDER.—C. R. ERKENS, 416 Van Der Venter Ave., Astoria, Long Island City, N. Y. This invention relates to an alloy to be used as a solder for uniting one strip or piece of aluminium to another, or for uniting one piece of aluminium to any other suitable metal. The solder may be used for the purpose stated without the heating of the parts to be united by a blow pipe or otherwise.

DESK.—S. GARAVAGNO, care of D. Garcia, Lagos, Box 5, Montevideo, Uruguay, South America. This desk is of compact form with flexible roll-top and a tilting shelf and occupies a minimum of space and has extensible members to give the requisite area when in operation; is provided with an attachment for latching an extended leaf in operative position; and is provided with means for holding the shelf in advanced or retracted position. It is for use with typewriting machines, stands for automatic music machines, sewing machines, etc.

ADJUSTABLE SCHOOL DESK AND SEAT.—S. MACC. JONES, Box 76, 1425 Superior St., Wilkinsburg, Pa. This invention relates to desks and seats for audience rooms, especially school rooms where it is desirable for the furniture to be adjusted in accordance with the stature of the several persons to use the same. The inventor has found by practical experience that the number of different sizes of school desks made in accordance with his invention may be reduced even more than one half, and yet easily come within the requirements of the law in some jurisdictions.

HEAT INSULATED RECEPTACLE.—R. HARTWIG, 12 Bregenzerstrasse, Berlin, Germany. Mr. Hartwig's invention consists essentially in providing within a vessel a joint adapted to be sealed, and providing this joint with a tensioning device, comprising the insulating ring, near the upper edge of the receptacle, and the inventor prefers to arrange the tensioning device between the inner and outer bottoms of the receptacle.

PROPELLER.—D. H. BLAKE, care of J. W. Happle, Sanderson, Texas. This invention relates to marine propellers, and the aim is to provide a form designed to give increased efficiency in proportion to its size, and to provide in connection with the improved propeller novel means of preventing a vacuum behind the propeller.

VAULT COVER.—H. SELLHEIM, 357 Stockholm St., Ridgewood, Brooklyn, N. Y. This cover is for use for cellars, vaults and the like, and is adapted to form a strong surface which will at the same time permit the passage of light to the cellar or vault below. In this device the transparent members or lenses can be readily removed, for the purpose of renewing the same.

Hardware and Tools.

WIRE ANCHOR.—F. T. REINERT, R. F. D. No. 3, Box 1, Aurora, Ill. This improvement relates to devices for connecting or anchoring the ends of fence wire or the like to posts. The anchor is preferably made of metal which may be of any suitable variety having in view the elements of cheapness and strength, and it may be galvanized for durability and appearance.

TOOL HANDLE HOLDER.—C. BERRY, care of Central Hotel, Grand Forks, N. D. This invention pertains especially to devices whereby a single holder may be used successively for attaching a single handle to various tools of similar or different character, or for the renewal of a broken or defective handle on a certain tool or set of tools such as garden rakes, hoes, forks, chisels, screw drivers and the like.

Machines and Mechanical Devices.

OIL SWAB HOLDER.—C. E. CALKINS, Las Cascadas, Canal Zone, Panama. The holder is the form of a cup constructed in two half sections hinged together so that they may be closed about a piston rod. The covers of the holder have flanges that are caught under lugs on the cup sections. A single screw thus holds the cup together and also locks the cover sections.

CHUCK.—F. J. CORNIL, 223 Cypress St., Argenta, Ark. This invention is a combination chuck whereby thin cylindrical work can be held by pressure from both inside and outside at the same time, thereby eliminating distortion. The jaws, which are reversible can be used in the usual manner, and also for clamping work thereto, said work being centered by lugs, and the clamps forming part of the jaws. A locking device for the jaws is included.

SUCTION WATER MOTOR.—J. O. KAFADER, Fort Bidwell, Cal. The purpose in this case is to provide a motor wherein the difference in height between two strata of the earth is utilized to create a suction adapted to aid in the operation of a motor, which in turn pumps water from the upper stratum, which is partly utilized, and any excess therefrom stored for other use.

VITASCOPE.—P. J. MUKAUTZ, 1656 E. 55th St., Cleveland, Ohio. This apparatus is for use in connection with a phonograph, the ar-

rangement being such that both instruments move in unison, so that persons may be represented upon a screen in an act or in conversation, the words for the lines which the actors are supposed to say being supplied by the phonograph at the appropriate time.

MACHINE FOR TESTING MATERIALS.—R. SCHILLER, manager, 150 Engerthstrasse, Vienna, XX/2, Austria. The object of this inventor is to provide a press of such a shape and arrangement of its parts that not only annular or tubular work-pieces, but also rod-shaped trial-pieces can be tested, both as to tensile strength and also as to resistance to collapse or buckling resistance.

SCREENING DEVICE.—O. R. SMITH, care of J. F. Carson, Box 141, Mullan, Idaho. This device relates to a new and improved screening mechanism used in the separation of different sized materials, and may be used at any place where it is desired to separate materials, as, for instance, grain, seed, ores, sand, different sized materials, etc.

Prime Movers and Their Accessories.

GASOLENE SPRAY OR VAPORIZER VALVE.—QUINCY ENGINE COMPANY, Quincy, Pa. The object of this improvement is to provide a device especially adapted to automatically regulate the fuel charge for explosion engines, both as regards the amount and relative proportion of ingredients of the mixture in accordance with the conditions to be met.

Railways and Their Accessories.

AUTOMATIC COUPLING DEVICE.—F. J. FITCH and G. BAUSBACK, Center and Market Sts., Pottsville, Pa. An object here is to provide a device which will automatically connect the main train pipe section, the steam pipes for heating the cars, and air pipe for signaling purposes and electric circuits for lighting or signaling. A further object is to provide a coupling head having a removable head in which the gaskets are disposed, thereby facilitating removal and replacements of the gaskets.

Pertaining to Recreation.

PUZZLE TOY.—A. L. POOLER, 24 Hammond St., Bangor, Maine. This invention comprehends a movable figure causing amusement because of the fantastic position it assumes, and as a puzzle the device constitutes a means of exciting great curiosity in attempting to change the figure from one extreme position to another.

Pertaining to Vehicles.

VEHICLE WHEEL.—J. W. MCCALLUM, Plymouth, Ind. This wheel is adapted to be assembled and bound together to form a continuous wheel from segments adapted to be assembled and bound together to form a continuous wheel; the segments are formed so that the members thereof are integrally related; and the maximum rigidity is obtained with a minimum weight.

LIGHTING SYSTEM FOR VEHICLES.—L. R. DUVAL, 558 Clinton Ave., Union Hill, N. J. This invention refers to electric lighting systems for use on motor vehicles, and more particularly to that type of system in which there is employed a dynamo driven from the engine for generating the necessary current for the side and tail lights and the searchlights.

Designs.

DESIGN FOR A SETTING FOR GEMS.—H. ACKERMAN, Weehawken, N. J. The shape of the base is circular, and the edge comprises six ornamental formations. The side elevation of the design is flaring and slants down toward the base.

DESIGN FOR A LAMP SHADE.—J. FRIEDBERG, Manhattan, N. Y., N. Y. This ornamental design for a lamp shade has the characteristic of extreme simplicity of form which nevertheless secures a very graceful result, both in plan presentation and side elevation view.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Sulphur at Home and Abroad

(Concluded from page 133.)

tion of sulphur in all the United States had not reached as high as 5,000 standard tons per annum, but due to the opening up of the Louisiana deposit, the figure jumped to 127,000 tons in 1904, and 369,444 tons in 1908. Since that year it has fluctuated around 250,000 tons, and last year totaled 265,664 tons. The yearly production of the Japanese mines averages about 40,000 tons, which is marketed principally in Australia.

The American sulphur interests were, prior to the outbreak of the war with Turkey, credited by the Italians with having obtained control of the sulphur fields of Cyrenaica—fields that extend along the desolate shore of the Gulf of Sidra, which the Arabs call Giun-el-Kebrit, or the "gulf of sulphur," just as they call the immediate region of the sulphur deposits Gebel-el-Kebrit, or the "zone of sulphur."

The alarm of the Italians arose from the landing in Cyrenaica from the private yacht of Allison V. Armour, a little less than two years ago, of a scientific expedition sent thither by the Archeological Institute of America, and headed by Prof. Richard Norton, of Harvard University. The purpose of this expedition was to excavate the ruins of the ancient city of Cyrene, the site of which is more than two hundred miles eastward of the sulphur territory.

A rumor that the Turkish Government had granted a concession to Americans for the exploitation of the Cyrenaica deposits was so far credited in Sicily as to be made the subject of an interpellative protest in the Italian parliament in February, 1911, by Deputy Vaccaro, of the Sicilian province of Girgenti, where the world's oldest sulphur operations mainly center.

It was pointed out by the southern deputy that "such a concession would fatally compromise the Sicilian industry," which, he asserted, could absolutely not resist the competition of an American company exploiting the Cyrenaica field.

In the month following the deputy's query, news came from Cyrene that Herbert Fletcher de Cou, of Michigan, one of the members of the American archeological expedition, had been slain by a hired trio of Arab assassins. The official report of the murder, as made to the Archeological Institute of America by Prof. Norton, contained the significant statement that "the Italians had spread false reports about my intentions; . . . that our true purpose was not to dig the ruins, but to mine for sulphur."

It is a favorite theory of Italian geologists that the island of Sicily, instead of being a detached part of the continent of Europe, in a prehistoric age formed the northernmost part of Africa. Those who hold to this belief regard the rich and abundant sulphur deposits of Sicily as the logical conclusion of a virgin stratification that must have its origin in the low mountain range that forms the plateau of Aurigi, to southward of the coastal plain of Cyrenaica. On this coastal plain, in the region of Gebel-el-Kebrit, the evidences of sulphur wealth have revealed themselves to modern science, not as a compact and well-defined area, such as Sicily's, but as a straggling drift, emanating from what, farther inland, must prove to be an exceedingly bountiful store of the mineral. However, it is only that part of the coast territory of Cyrenaica lying within a few days' journey by horseback from the sea that has been explored by Europeans competent to judge of sulphur productivity.

An authority recently delegated by the Italian Government to investigate and report upon the sulphur prospects of Cyrenaica was Dr. Salvatore Giannò, who visited the country in the capacity of commercial *attaché* of the Italian legation at Constantinople. Writing in the *Rivista Coloniale*, organ of the Italian Colonial Institute, Dr. Giannò lately observed:

It appears evident that the sulphurous zone in Cyrenaica describes an angle thus: Muktar, Oasis of Abu-Naim, Hara-Docha, form-

ing a line of resistance to the rich mineral drift of the Sicilian coast, which, starting from the base of Mount Etna, follows the mountainous chain to Lecara, and thence to the mountains of Gibellina. . . . The sulphurous stratum, therefore, in Cyrenaica, lacking a scientific exploration in the true sense of the word, may not, indeed, must not, be restricted to the known deposits, or to those caves, or quarries, exploited crudely and in embryo by the Arabs, but must be found to follow the mountainous line that stretches from Ara del Fileni to confine the Plain of Barca.

That low chain of mountains which extends from Sebka-Muktar to Gebel-el-Ala, to Gebel-dj-Djeria, to Frerin, to Maradek, to Marsa-Braiga, and so to Hara-Docha, is a vast deposit of sulphur, part explored, but the greater part unexplored. From ancient times the inhabitants of the region have been given to a superficial working of the deposits, not for the uses wherefor sulphur is most in demand by the market, but for that, infinitely more modest, of doctoring camels afflicted with the mange, and the outlet on the sea, or gulf, for the product, is always the port of Marsa-Braiga, whence the sulphur is dispatched by sailing vessels to the caravan ports—Tripoli, Benghazi, Alexandria.

To the south of Marsa-Braiga, a small natural port on the Gulf of the Great Sidra, there is a quarry already in operation. It is called Kofra-el-Kebrit (Cave of Sulphur) and from this the Arabs extract the product. This quarry is distant about twelve hours from the shore. Another deposit, which I believe to be the richer, is found to the southwest of Gebel-dj-Djeria. This follows the little mountainous chain extending from Muktar to Hara-Docha, and the stratum is so ample that it is to be traced in four days' journey by horse in the direction of the meridian. The quality of this sulphur is of the best, and the mineral, without being attached to the rock, presents itself in a purer state, and in greater quantity as depth is attained.

The richness of the mineral, from examinations made on the field of the quarries in operation, needs not to be discussed; from experiments made it yields an *ottavo* of purity. . . . The primitive and superficial operations of the Arabs in the aforesaid quarries indicate that the mineral they obtain is that which is found in the first stratum—exposed, as it were, at but a few meters of depth; while at the second stratum there is always observed a sure improvement in the quality of the mineral, and at the third stratum it betters in exact ratio to the depth attained. Where thick, the sulphur is found to be richer than where it is submerged in water.

Sugar Beet Industry of Germany

(*Concluded from page 134.*)

The thinning of the beets as well as their cultivation is a work to which (according to the German idea) women are especially adapted. Their wages as field hands are only about 60 per cent that of men, although in this kind of work they do about as much. The extension of sugar beet growing in Germany quickly brought about a shortage of labor and caused the introduction of what is known as the "season workers" or immigrant laborers, who are brought in to work during the beet season, and at the close of it are sent back to where they came from. Every spring hundreds of thousands, in recent years over 400,000 men and women, come from the eastern provinces of Germany, from Russia, Hungary and Bohemia, to the central and western provinces of Germany to work, principally in the sugar beet fields.

So important has this large movement of foreign laborers become that legislation has been passed specifying the time (15th of November for central Germany) by which they must all be returned.

The large property owners have made special provisions for caring for this foreign labor by erecting barracks for them to live in. In addition to a cash wage, an allowance is given in provisions such as potatoes, meat and flour. The beet growers prefer to get as large a proportion of women as they can, and as a consequence many more women than men are to be seen working in the German beet fields.

The influx of such large numbers of foreign workers onto the farms during the summer months naturally has a detrimental effect, both socially and morally, and while it has solved the problem of furnishing the necessary help during the summer months, it has resulted in driving out the native farm laborers, who have been unwilling to compete with the season workers, and they have gone into other industries or moved away, so that during the remainder of

AVIATION

¶ Two topics are of paramount importance just now in aviation. The one is the possibilities of the hydro-aeroplane—the flying boat in popular parlance—and the other is the flying machine as a military weapon.

¶ In the forthcoming mid-month September issue of the Scientific American, which will issue on September 14, these two subjects will be authoritatively discussed.

¶ Mr. Carl Dienstbach writes on the hydro-aeroplane. He points out how important is the development of the flying boat, because at last we have a vehicle of the air which is safe and which means much for the advancement of flying as a sport.

¶ Major Bannerman Phillips of the British Army, a noted European authority on the military aspects of aviation, will write on bomb-dropping. He will show how much or how little is to be expected by dropping high explosives on an enemy's force from a height of half a mile, basing his comments on the achievements of aerial grenadiers in the Tripolitan campaign and on the results of the bomb-dropping contest held in France.

¶ Dr. Alfred Zahm, America's leading authority on aero-mechanics, will show in a popularly worded article what has been the development of laboratory work since the day of Langley. If the flying machine is to become a really practical vehicle of the air it must be developed by the same methods that have given us the giant bridges, the hugh dynamos, the highly ramified telephone. That is why Dr. Zahm's article, dealing as it does with investigations made by engineers and physicists, is of immense practical value.

¶ There will also be the usual Scientific American features—the short pithy articles on current scientific events, with many bright illustrations of the latest inventions and scientific apparatus, the latest news for inventors.

¶ Price 15 cents on all news stands.

the year there is a scarcity of farm labor.

To an American it is repugnant to see thirty or forty women working in a beet field under a man boss, but when he raises any question as to the fitness of it, he is quickly told that it is better for them than working in American factories in our large cities. Perhaps it is, because for the most part they are young, strong Bohemian and Polish women who seem to have as much physical strength as a man. But it is all contrary to the American conception of the sphere of woman, and if sugar beet culture cannot succeed in America without the general adoption of the use of women laborers, it is not likely to make any great progress, and we shall continue to import our sugar.

Germany's Gain in Exporting Sugar.

Germany, with its annual export of 800,000 to 1,000,000 tons of sugar, worth $50,000,000, is gaining not only that volume of international trade, but is not losing a penny's worth of plant food from the soil, because sugar is nothing but sunshine, water and carbon dioxide. On the other hand, the United States imports over $100,000,000 of sugar every year, and exports cereals and cereal products to a value of over $130,000,000. These cereals are all rich in the elements of plant food that come from the soil and determine the degree of fertility of the land. These elements, nitrogen, phosphoric acid and potash, have a stable market value at which they are sold in the form of commercial fertilizers. It is a simple matter of calculation to determine what it would cost to replace the plant food that we lose each year through our export of cereals and cereal-products, and estimating these on the most conservative basis it amounts to at least $30,000,000.

This certainly is wise economics from the standpoint of German agriculture, and so long as Germany can find a market for its sugar, they can well afford to import the grains, mill-feeds and other concentrates, and thus build up their own agriculture, but from the standpoint of the United States, we cannot afford to go on paying out over $100,000,000 per year for sunshine, water and carbon dioxide manufactured into the form of sugar.

Germany's Interest in American Beet Sugar.

Since the beginning of the beet sugar industry in America, Germany has watched its development anxiously. Many investigations have been made of it, and as much or more has been published in Germany concerning it as in America. The consensus of opinion here seems to be that the one great obstacle to sugar beet production in America is the labor problem. The fact that America does not have the cheap labor of Europe, and especially that women are not used as field laborers, the Germans think is sufficient to keep the United States from becoming any serious competitor. But notwithstanding these handicaps, and the fact that the beet sugar industry has only been established in the United States about twenty years, we already produce one fourth as much beet sugar as Germany, and the production is constantly increasing.

The United States uses more sugar than any other nation, and although only two other nations surpass it in the amount produced, Germany and Russia, it is still necessary to import more sugar than any other country in order to supply our needs. Last year the importations amounted to over two million tons, and in addition to this one and one half million tons were produced within our borders, including Hawaii and Porto Rico, approximately one million tons being produced from sugar cane and one half million from sugar beets.

We may increase our sugar production as much as the total production of Germany at the present time, and we will only be producing enough to supply our own consumption. Surely as far as the United States is concerned there is no great danger of lacking a market for all the sugar we may produce.

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